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MODERN PLASTICS

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SEPTEMBER 1938 VOLUME 16 NUMBER 1

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• OCTOBER NUMBER

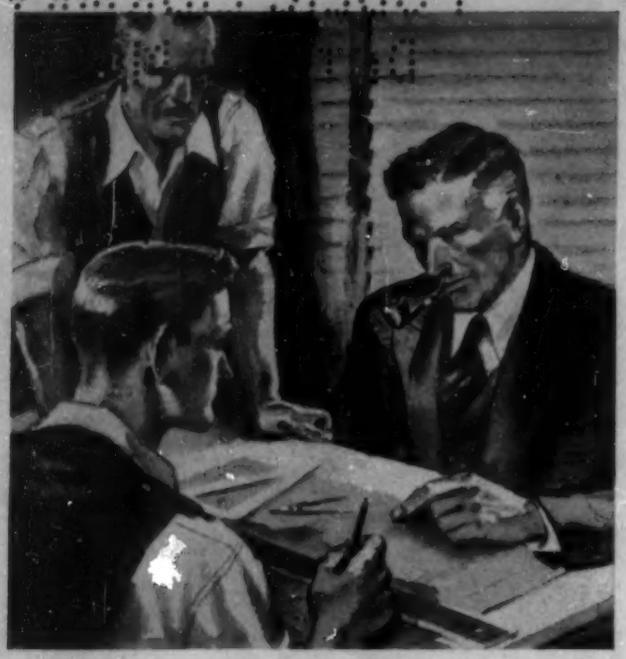
For the third consecutive year our October issue will be the Handbook-Catalog-Directory Number and will record for easy reference all major developments in materials and methods that have occurred during the past twelve months.

Forty-six articles, each written by an authority in his field, provide this reference manual with a wealth of invaluable factual data obtainable from no other single source.

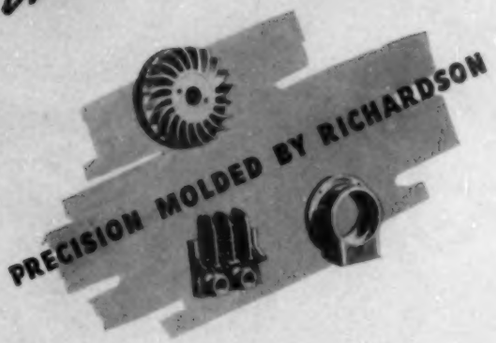
The Properties Chart, which reflects the co-operative effort of chemists and engineers in more than fifty manufacturing plants where plastic materials are made, offers the widest possible comparison between the various types of plastic materials in the American market.

A survey of the advancement of plastics production and fabrication in five foreign countries will be included, together with a comprehensive report of their development in this country written by Dr. V. D. Reed of the U. S. Bureau of Census. The Directory Section has been rewritten and revised.

ADVERTISING PAGES REMOVED



We always get the TOUGH JOBS



INSUROK

THE SUPERIOR PLASTIC

IT is significant that difficult plastics jobs, almost without exception find their way to Richardson—jobs requiring intricate, involved dies and molds; modern production equipment; advanced molding technique; specialized abilities that encompass the use of numerous types and grades of synthetic materials.

To these unmatched facilities Richardson adds a comprehensive knowledge of the capabilities and limitations of plastics, a thorough understanding of the needs of industry, the stability of more than 75 years of successful manufacturing and, most important, scientists and technicians in design, research and engineering laboratories and skilled artisans and craftsmen in production departments—all "tops" in the plastics arts.

It is not surprising, therefore, that manufacturers who wish a permanent, satisfactory and wholly dependable source of supply instinctively turn to Richardson. You will find it profitable to avail yourself of complete Richardson service. Details and literature will be sent on request.

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MODERN PLASTICS

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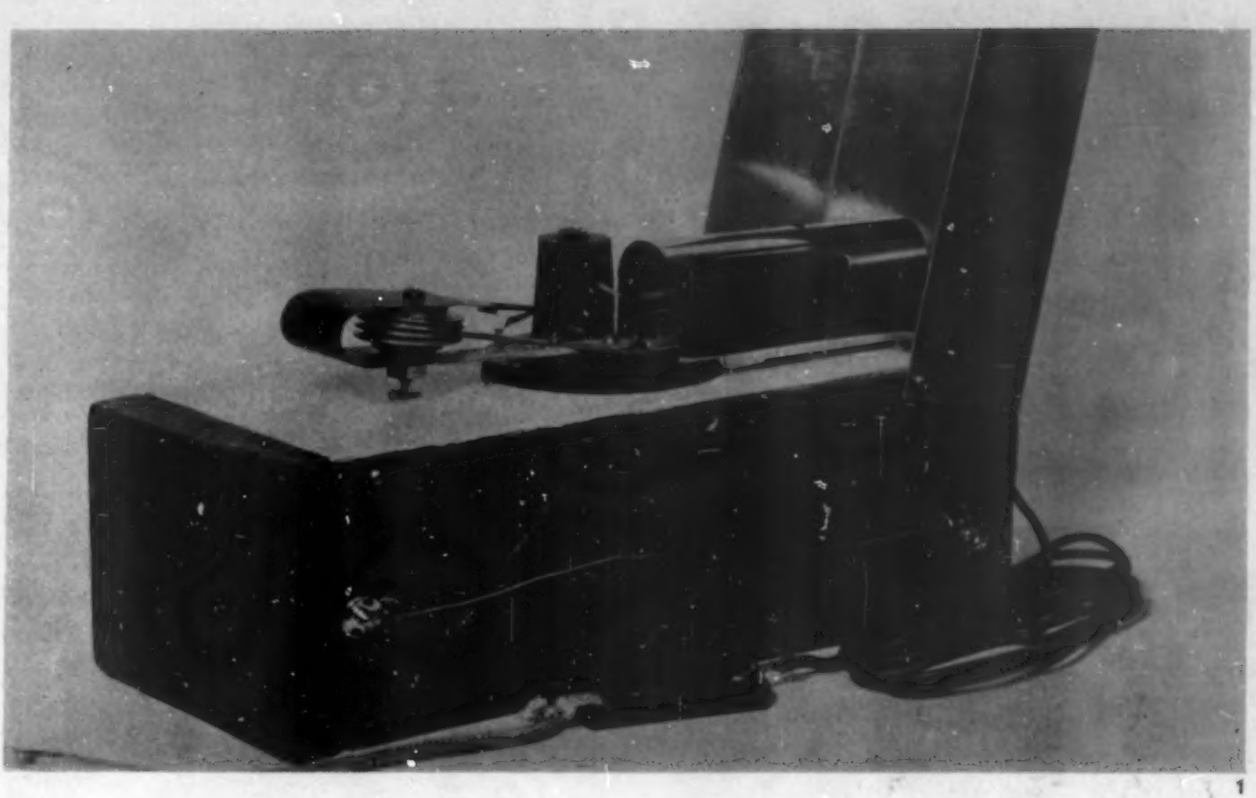

1

PLASTICS PAY THEIR DEBT TO PURE SCIENCE

by DON MASSON*

Well, at least they are beginning to meet installments regularly

THAT THE PLASTICS INDUSTRY, CREATED BY intensive chemical and scientific research, should in turn be the means of advancing science and the development of new industries has always been expected. The important contributions made by modern plastics to such industries, as aviation, household appliances, building, business machines, abrasives, home furnishings, photography and optics, packaging, radio, machinery, fashions, automobiles, paints and varnishes, communications, music and health are well known. But there are certain other applications—perhaps, offshoots of these industries and roots of newer industries—which dramatize vividly those properties of plastics which are so vital to the development of pure science and its eventual application in industry.

While it is impossible to mention all of these contributions in detail, a few illustrations may serve to show what plastics do to help unravel the mysteries of nature, twenty miles up in the air, for laboratory tests on the surface of the earth, and finally, in testing the products of the very bowels of the earth for purity.

To help the weather man in his predictions, instruments with their foundations on a molded plastic base—serving not only as a part of a clock mechanism but actually protecting this delicate mechanism—ascend some

* Bakelite Corporation

2

To help the weather man in his predictions, this Harvard Radio-meteorograph (Fig. 1) is carried twenty miles into the air by a four-foot balloon (Fig. 3). It weighs but twelve ounces but contains a radio transmitter and instruments which record pressure, temperature and humidity automatically at all heights (Fig. 5) on apparatus (Fig. 4) which doesn't leave the ground. Fig. 2 is a Bakelite molded instrument base which serves as part of the clock mechanism to drive the instrument and to protect the delicate contact mechanism. It must work in all kinds of weather and temperatures as low as 94° F. below zero have been recorded

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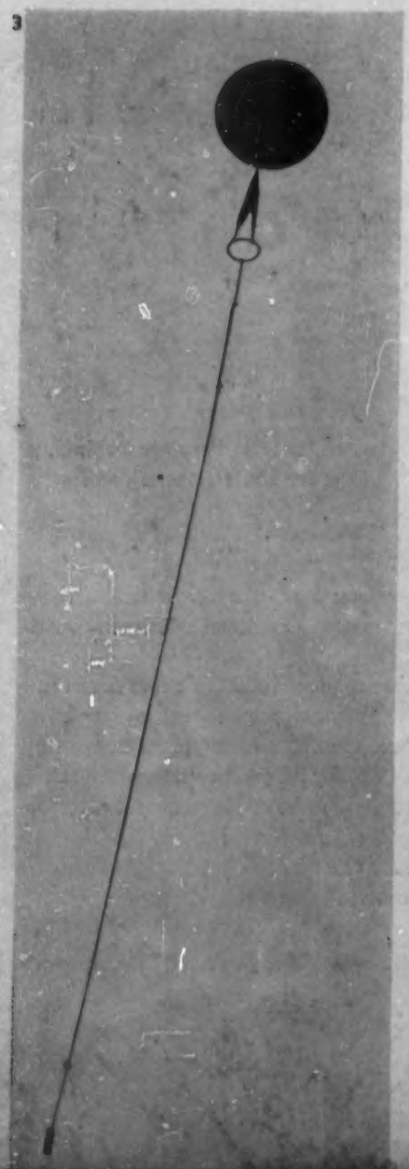

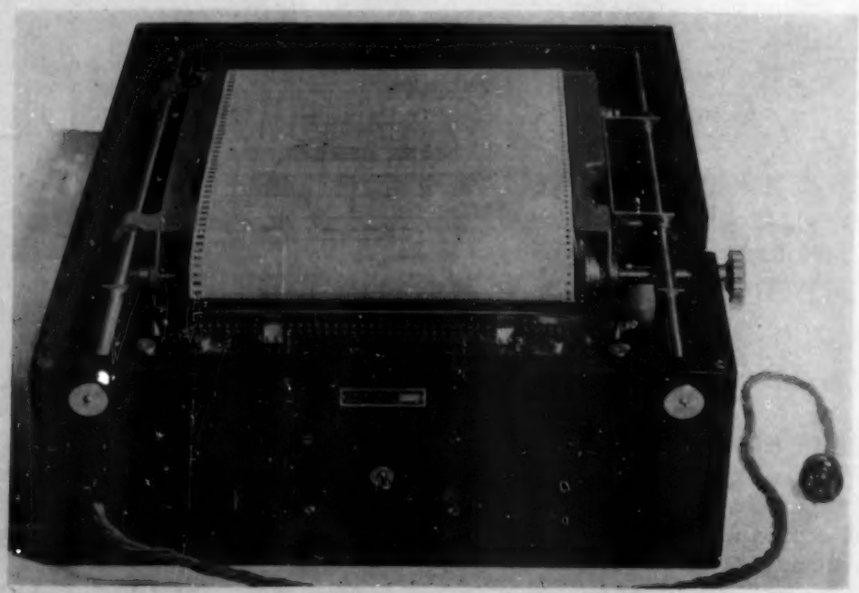

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100,000 feet into the heavens. One such instrument, known as the Harvard radio-meteorograph, was developed by the staff of Harvard University's Blue Hill Observatory, under the direction of Dr. Karl O. Lange, to record the pressure, temperature and humidity of the air. The fact that the cost of this instrument is less than the cost of an airplane ascension—and, as a matter of fact, no present-day airplane has come within reaching half that stupefying altitude—and that the instrument operates at temperatures as low as minus 94 degrees F. is an important factor in meteorological observation.

The amazing compactness of the Harvard radio-meteorograph, which weighs only 12 ounces and contains a radio transmitter and instruments to record pressure, temperature and humidity, is suggestive of what can be done through the use of plastic materials. These instruments are sent up on small rubber balloons which have a diameter of about four feet. While at present the daily routine observations in Boston go to a height of only from 30,000 to 75,000 feet, heights of over 100,000 feet have been attained.

Ascending from the earth, the radio-meteorograph measures the air temperatures and humidity and pressure at all levels and at the same time records the heights at which these measurements were taken. These measurements are automatically sent down to the ground by radio and recorded as accurate registrations of temperature, humidity and pressure. Although the instrument is usually lost, this is not an important factor because of its comparatively low cost of production and because all figures have automatically been recorded at the observatory station. The results of these "soundings" make for more accurate weather forecasting and it is reported that the U. S. Weather Bureau plans to expand its radio-meteorograph service through the use of this compact, all-weather instrument.

Around and around

Coming down to earth, here is only one of many new tools for research and laboratory work—the Sharples vacuum ultra-centrifuge which also plays an important part in the progressive industrial plant. Here again, a molded plastic is literally defying the laws of gravity, for it is traveling at the rate of 80,000 revolutions per minute which is equivalent to a centrifugal force of 250,000 times the force of gravity.

This particular ultra-centrifuge will separate two liquids that are in solution; molecules will sediment under the intense force; colloids will concentrate and their rate of movement can be photographically measured; and filterable virus can be concentrated. These instruments have aided in the study of the size and nature of colloid particles as formed under varying conditions. The means of operation is through the measurement of the passage of light rays through the instrument.

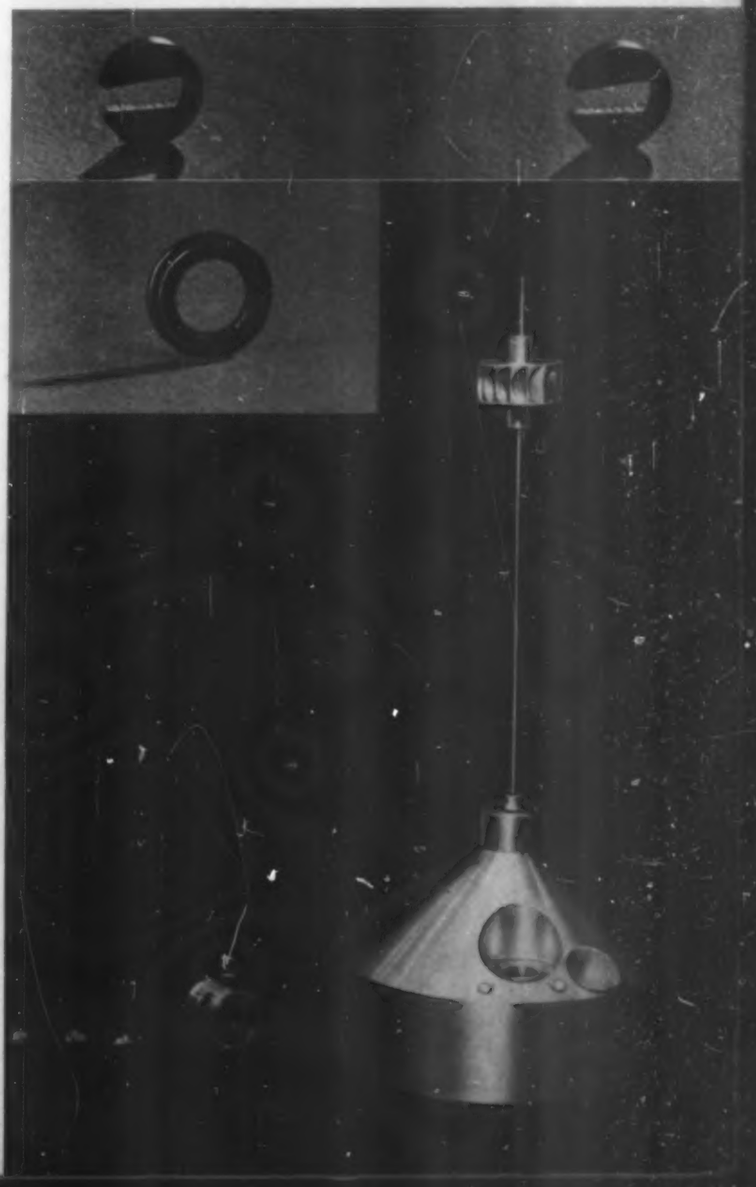
A cell is installed in a rotor operated at 80,000 R.P.M. The rotor is suspended on a vertical axis, and metallic mirrors, made by the condensation method, direct light through the cell and then into a camera so that photographs may be taken at regular intervals, making use of the light absorption of the sample to be studied. Two black phenolic discs are used—because of the lightness and strength of the material—to keep the light ray on its allotted path. Still another plastic part is the round bushing on which the high-speed rotor comes to rest.

Stays put

While the previous two applications of plastics dramatize the durability of the material under conditions of extreme stress, high speed and weathering, plastics also play an important part in a static way where impermeability to chemical reagents is paramount. Metallurgists and geologists are frequently confronted with the problem of mounting metal specimens for microscopic examination, and they have found that plastics offer the most satisfactory type of mounting to date.

(Please turn to page 66)

Undoubtedly, one of the highest speeds a Bakelite material has ever traveled is 80,000 revolutions per minute in the new Sharples' vacuum ultra-centrifuge. This is equivalent to a centrifugal force of 250,000 times the force of gravity. Light is directed through a tiny cell installed in the rotor, and then passes into a camera so that photographs may be taken at this high speed. Two Bakelite molded discs are employed in the cell to keep the light ray on its allotted path



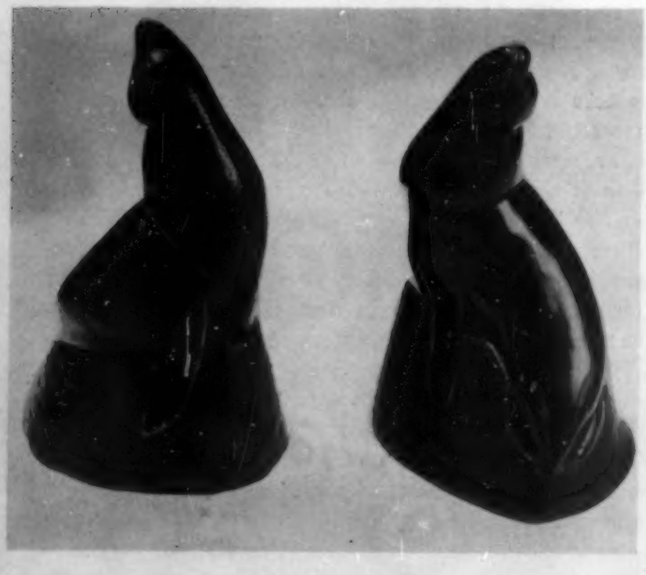
ARTISTS EXPERIMENT

APHRODITE, OR VENUS WHO ACCORDING TO the doctrines of mythology was the goddess of love in that broad sense of the word which in early times embraced the love of animals and was considered to be the cause of productiveness throughout nature was revered by the early Greeks and Phoenecians who spread her worship wherever they established factories or markets in Greece.

Illicit daughter of Jupiter and Dione, Venus exhibited a character in which all that was good and noble was contrasted in times of luxury with impurities of many kinds. "In Paphos, an early city in Cyprus," according to Murray (*Manual of Mythology by Alexander S. Murray*) "Venus was worshipped in the form of a ball or a pyramid encircled with burning torchieres as may be seen on the coins of Cyprus. As art advanced, she took a finer form, fresh charms being continually added until all the resources of expressing imperious, overpowering beauty were exhausted. In the best days of art she was always represented draped, in later times nude, and in many attitudes."

The Venus of Milo, accredited to Phidias and originally created in *Marble Pario*, has been preserved through the ages and has been reproduced and recreated in various materials capable of expressing the sculptor's art. Many changes have occurred in the transition yet sufficient of line and form have remained to express the ethereal beauty and romance so essentially associated with early Greek art.

I'm not at all sure that Phidias would approve the most modern version, pictured at the left, but it marks the entrance of plastics into the reproduction of *objet d'art* on a high commercial plane. It is of transparent



WITH MODERN PLASTICS

phenolic resin cast in a rubber mold by Ralph Mancuso. The blue-white tones and clear transparency of the material bring a feeling of true modernism to a subject steeped in tradition, and indicate the appreciation of these newer materials which modern artists entertain.

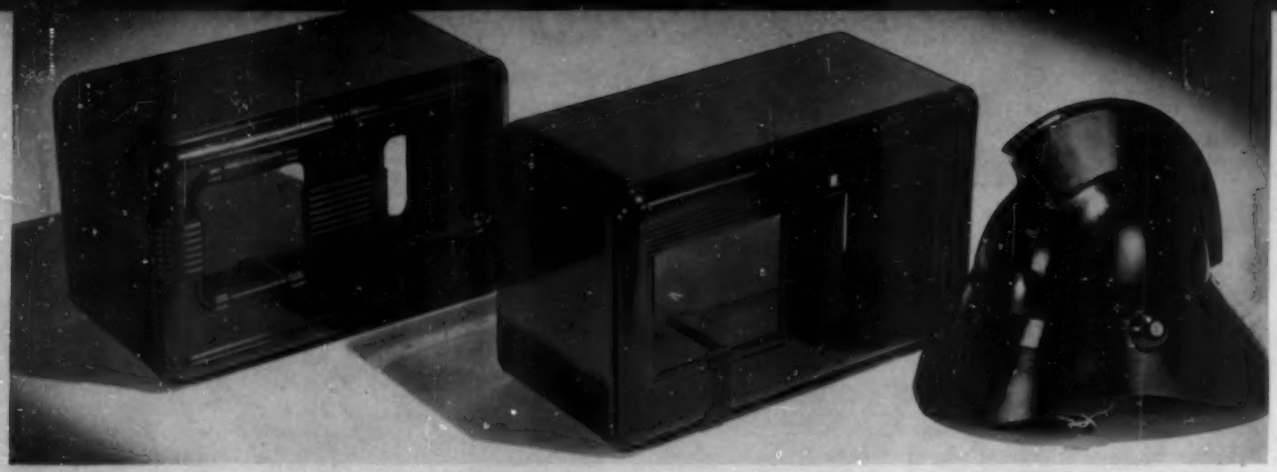
Polar bears and ducks, pictured below, are original subjects modeled by C. K. Castaing and cast in black and deep blue phenolic resins with rubber molds.

The mural at the right, by Stuyvesant Van Veen, represents an original method of handling laminated plastics by which vertical and horizontal seams or joints common to most uses of these products are eliminated. By cutting each shape and form incorporated in the mural from sheets of available size, Mr. Van Veen is able to create a mural of considerable area in which all butting joints become the outline of the shapes involved. In this way he overcomes the limitations of sizes provided in laminated sheets. With the recent introduction of urea resins into the laminated products, an unlimited choice of colors is made available.

Although difficult to design and tedious to execute in this way, murals of laminated plastics immediately possess the permanence so desired in this form of decoration and withstand the more or less constant cleansing essential to sanitation in public buildings. Their colors, if proper materials are chosen, will age well and remain fresh and brilliant over a period of many years.

Examples are not yet available, but there is every reason to believe that translucent laminated ureas in the hands of competent and imaginative artists will take their place sometime in the future beside leaded glass where they will compare favorably in appearance and render longer and less fragile service.

The statuette of Venus at the extreme left is Prystal, a transparent phenolic resin, cast in a rubber mold by Ralph Mancuso. The seal bookends and ducks, in which a fine feeling of textured surfaces is apparent, are Bakelite resinoid, reproduced by casting in rubber molds from originals by C. K. Castaing. The mural, above, is Micarta, a laminated product, designed and executed by Stuyvesant Van Veen



MOLDINGS FROM AUSTRALIA

JOHN DERHAM, DIRECTOR OF MOULDED PRODucts Pty. Ltd., Melbourne, Australia, who visited the United States last year; sent these interesting plastic products, that our readers might see examples of the splendid work being done on that progressive continent.

Four perhaps, are more intriguing than the remainder because of their construction or application. The helmet is molded of resin impregnated canvas; light and exceedingly strong. Even the side buttons which screw through the trim band, holding the lining and chin strap in place, are molded phenolic with a metal insert. The five-inch deep-sea fishing reel has a molded spool and backplate of canvas-filled material, giving it sufficient strength to land "whoppers." Molded handles make it easy to reel them in.

The change-tray, advertising "Three Threes" cigarets is an excellent display piece, well molded in two parts. And the all-molded lavatory seat, should excite the envy of any American molder. All are displayed at Modern Plastics Exhibit—425 Fourth Avenue, New York City.

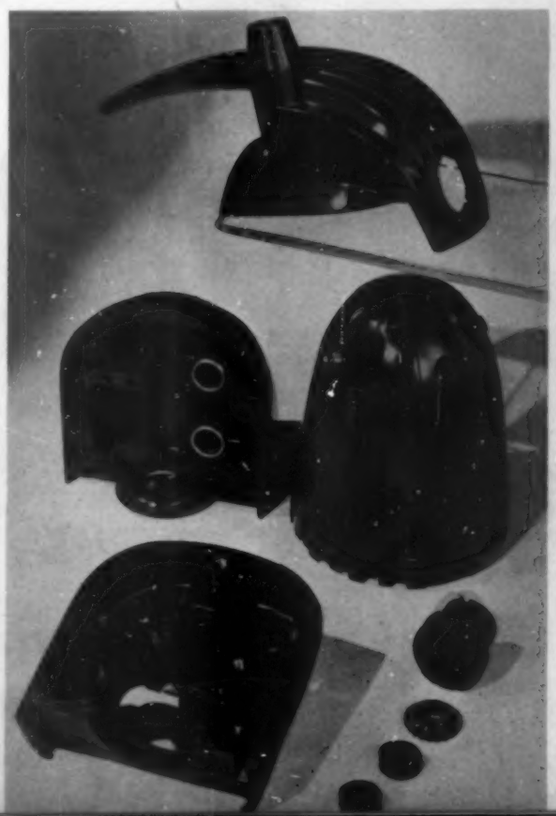
MODERN MIXER

TWO YEARS WERE REQUIRED TO CREATE THIS smart, businesslike Kitchen Kit Electric Food Mixer introduced recently by A. C. Gilbert Co. To begin with, a new type of motor capable of sixteen different speeds was developed. Speeds are controlled with the tip of a thumb. It stirs, mixes, beats, or extracts juice quickly without effort; is clean, sanitary and a pleasure to use.

Four of the eight molded parts shown below demonstrate the painstaking engineering and planning necessary to create a small motor housing that will provide accurate operation and rapid assembly for a mass market. Keys, slots, guides and inserts must be positively positioned within close limitations and remain where they are placed regardless of use.

Plastics were chosen because they provide this accuracy so essential to the successful use of the mixer. They provide the natural insulation which makes the device safe to use. Beyond this, they provide a natural finish which survives any that could be applied and assure a bright and natural luster throughout the life of the machine. Navy blue, dark grey and maroon are the colors chosen and the supporting arm is available in either polished chromium or white baked enamel. Standard equipment includes two especially designed opaque white mixing bowls and a juice extractor bowl.

The design is modern without being *gadgety* and exhibits the intelligent combination of plastics with metal, each in its proper place to render continuous consumer satisfaction. Lines are smooth and free-flowing with simple decorative relief so easily achieved through molded parts. The molded handle is shaped for a convenient grip and both color and finish are permanent because they are molded in.



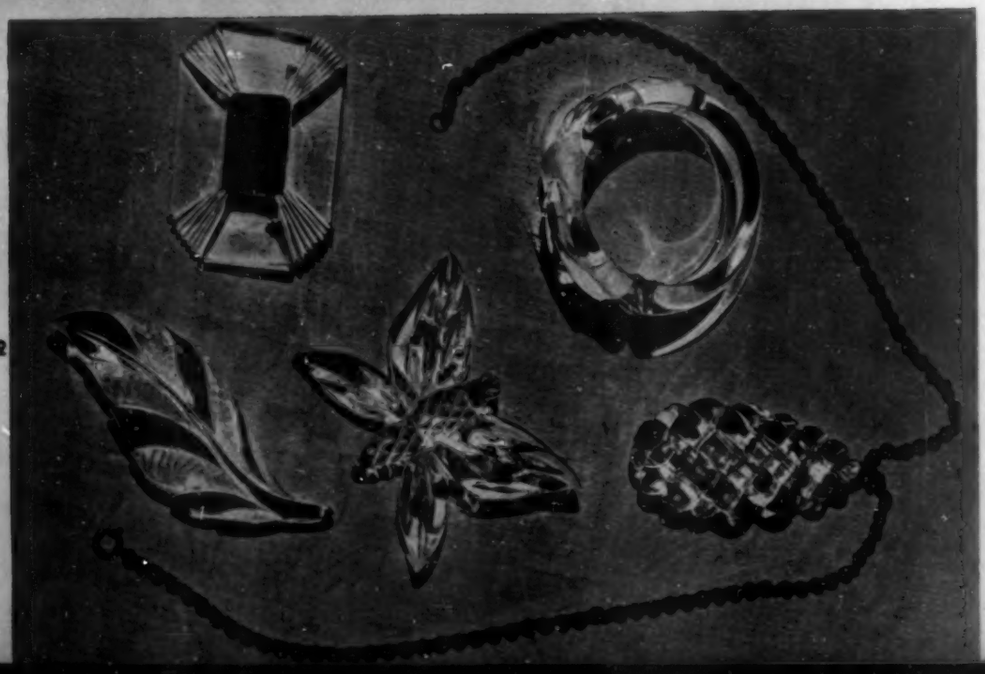
The Kitchen Kit, above, with juice extracting attachment shown below was designed for A. C. Gilbert Co. by Robert Heller. Plastic handle, housing and controls are molded of Durez by T. F. Butterfield, Inc., from dies made by Special Tool & Machine Company

ENDURING TRANSPARENCIES

BY EVE MAIN

1

PHOTOS, COURTESY DU PONT



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FASHION PACE-SETTERS, BOTH AT HOME and abroad, are glamorizing smart Fall outfits with massive-looking jewelry, and crystal pieces are leading by a good length. Right in step with the mode are these new costume complementers. Hand-carved and hand-cut from methyl methacrylate, a clear transparent plastic, they have all the beauty, sparkle, and brilliance of natural crystal, yet weigh only about one-third as much. (1, 2, 3) Long necklaces; drops that are three or four inches long, for pendants; bracelets, plain bands with conventionalized leaf patterns at each end or elaborately carved and mounted with a single flower; brooches with bird, fish, flower, leaf, and bowknot motifs—all are fashionably bulky, yet light in weight and comfortable to wear. More than that, they'll not chip nor break however roughly they are treated. (Cohn and Rosenberger) (4) A top-handle, shirred pouch of French antelope (left) is built on a frame of water clear methyl methacrylate. A back-strap pouch bag (right) with all-over cross-stitched embroidery has an intricately carved top of the same material. (Deauville Bags) (5) A soft under-arm bag of French antelope has a delicately cut transparent plastic frame. The same trim and motif are carried out in short gloves which complete the bag and glove ensemble. (Lewis Purses, Inc.)

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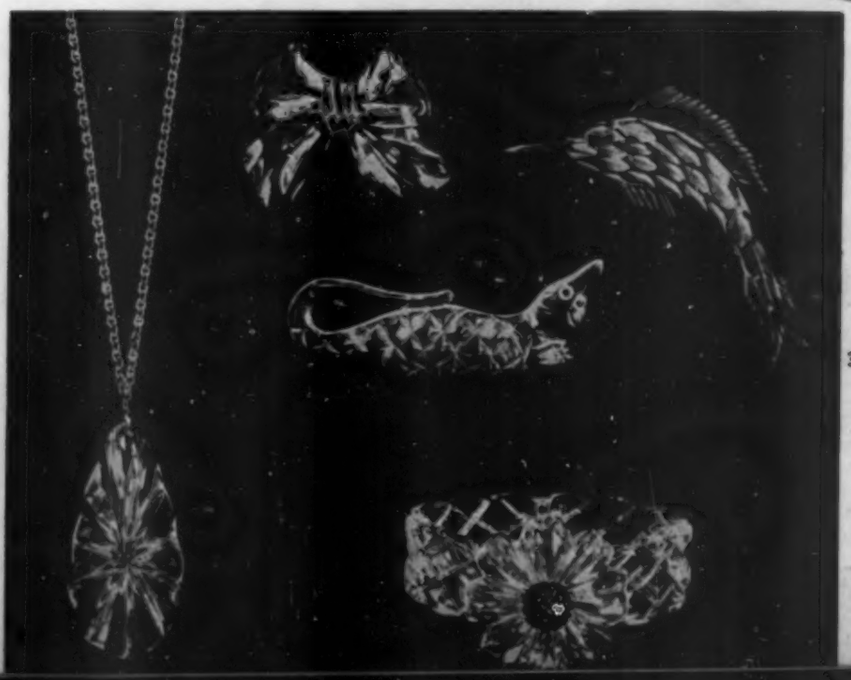


3

METALIZING PLASTIC SURFACES

For which a new process is made available to the trade

YOU MAY WONDER WHY ANYONE WOULD want to put a plating of gold or silver on a piece of molded plastic. We did too. It would seem that where plastics can be molded in such beautiful colors there would be no need to decorate them with an allover coating of metal. If one wanted a metal piece, it would seem logical to make it metal all the way through just as plastics are plastics all the way through. But there are reasons and some of them are very practical reasons in which industrial and decorative applications share alike.

One of the stories that excited our interest in this process of metal plating on plastics was about a manufacturer who got stuck with thousands of strings of plastic beads. Stuck? Well, in making up his stock for the season's business he chose too many of several colors which he found later didn't sell. Since you can't very well change the color of plastics after they have been made up into beads, he thought he was stuck. Then he discovered that they could be plated with silver and gold and looked for all the world like the genuine product. Although plastic beads are solid (while metal beads are hollow with visible seams) they are so light in weight that they resembled gold and silver beads, even in feel and weight, and when plated, no seams showed.

What happened? Why, this manufacturer not only sold all his plastic beads at a better price than he had

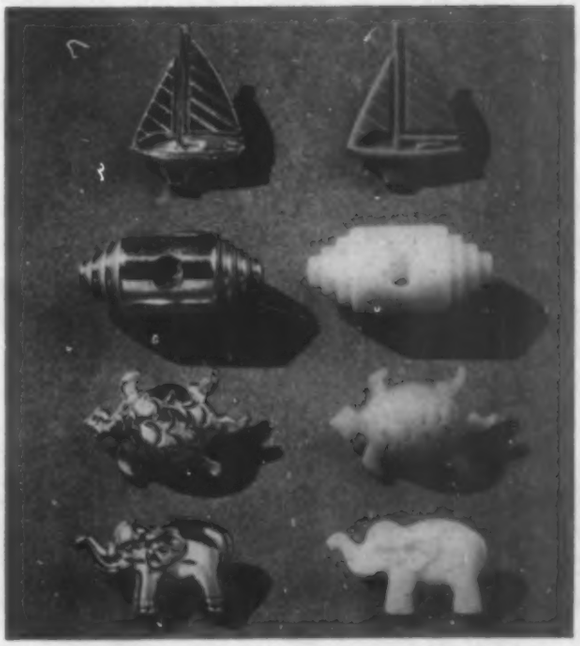
These plastic objects have been gold or silver plated with the Metaplast Process now available to the trade. Cast resin beads and jewelry become gold or silver through the process yet retain their light weight and unbreakable characteristics. The razor, light as a feather, looks for all the world like silver, with which it is simply plated. Cigaret holders may be given precious metal tips at little cost, leaving their plastic stems exposed

obtained in the beginning, but he found that plastic beads, plated with a substantial coating of these precious metals, were actually cheaper to make than metal beads and sold equally well.

That isn't an isolated instance of the advantages of plating either. We recently announced (June 1938) that Northwest Airlines were using acrylic resin electro-static shields to cover the directional loop radio antenna on their new Lockheed planes. Transparent plastics were used because they improved the appearance of the planes while insulating the sensitive apparatus placed behind the shield. Trouble was that the plastic proved to be such perfect insulation that it set up its own static and had to be grounded. In every other way it proved better than metal, so the company officials were reluctant to return to another material. It was found that by electro-plating narrow bands of metal across the surface of the shielding hood, it could be efficiently grounded without sacrificing the attractive appearance of the shield.

If you will glance at the first illustration, you will see one of the strings of beads with its silver clasp. You will see a safety razor, molded of plastics, plated with silver. It is light as a feather and probably more acceptable to many men than it would be without the plating because they are in the habit of using metal razors. The plating on the fountain pen barrel at the extreme right distinguishes the pen from the common variety, yet adds little to its weight and cost. The two cigaret holders shown between the razor and pen barrel are of cast resin, all in one piece. But the plating, one of silver, the other of gold near the ends, give them the appearance of having metal tips. At the extreme left is a cast resin clip, ground and polished with floral and leaf pattern; and a section of a cast resin bracelet made the same way. Both have been given a heavy gold plate which creates the appearance of metal with the inherent light weight and intricacy of design which plastics alone can give.

Since the part being plated can be masked, allowing the coat of metal to adhere only to the exposed portions, intricate designs simulating inlay may be employed on either molded or laminated materials. Company names can be plated on plastic boxes for decorative packaging. Inlay stripes can be plated on handles. Monograms on closures. Designs on buttons, combs, cosmetic containers, vanity cases, shields, pencils, pens, or any number of popular items where metal decoration would serve as identification or to enhance the appearance of an otherwise plain piece. *(Please turn to page 68)*



The box cover at the top, molded for Bourjois, Paris, has been treated to a lovely coating of antique silver while the shaving stick box molded in England, has the gloss of bright silver. Salt shakers, before and after plating, together with radio knobs and a bottle closure appear below. Buttons and small ornaments of cellulose acetate are shown plated and as they come from the injection press. The plating accentuates every line in the design of the original molding because lights and shadows find greater play on the metalized surfaces

INGERSOLL SHAVER

"First with a dependable, low-priced watch"—now—"First with a dependable low-priced electric shaver." You've guessed it. Ingersoll—the name that made the dollar watch an American symbol, now enters the field of electric shavers.

There's one way to make a new shaver stand out today, and that is to mold it of Plaskon.* The clean, sanitary look of Plaskon ivory, for instance, gives a shaver housing that deluxe look, puts it in a quality class apart from run-of-the-mill black housings—at a very slight extra cost. In this Ingersoll housing, fine relief ribbing and incised wiped-in trademark supply the decorative touch.

Watertown Manufacturing Company do the Ingersoll molding.

*Trade Mark Reg. U.S. Pat. Off.

PLASKON

LIGHT-WEIGHT LIGHT

A far cry from the old "chandelier" that dangled from pre-war ceilings is the modern Plaskon bowl type of fixture. As Markel puts it, "these plastic bowls of glowing light are today's most scientific development in better light for better sight."

Plaskon, you know, is supplied in special types for lighting bowls, with variations of pigmentation to secure any desired balance between reflection and transmission. Most of the light output is usually reflected to the ceiling, with enough passing through the bowl to eliminate shadows. Besides this scientific light distribution, Plaskon gives fixture and lamp manufacturers, extremely light weight, far less breakage, fewer damage claims, and more uniform reflectors.

These Markel fixtures use white and ivory Plaskon, which harmonizes well with the gray and white enamel and the gold trim. Bryant Electric Company mold the bowls for Markel Electric Products, Inc., Buffalo, N. Y.

PLASKON

2121 SYLVAN AVE.

CANADIAN AGENT CANADIAN

SEPTEMBER 1938

IVORY HUSKS

If anyone had predicted, five years ago, that ivory Plaskon would replace the dark and cheaper plastics used for Christmas tree light sockets—no one would have listened. Why use a more costly material when you can't see the sockets on the tree?

But, sure enough, lighting outfit manufacturers swung over to ivory Plaskon—for one important reason: the outfits are bought over counters, not on trees, and the set that sells best is the one that looks best in the store. And any department store buyer agrees that light-colored Plaskon with its soft lustrous finish, and translucent depth of color is much more pleasing than the dark opaque colors formerly used.

Raylite Trading Corporation, New York, manufactures these Paramount sets. Terkelson Machine & Tool Co., mold the sockets.

MOLDED COLOR

GRAY AND SCARLET

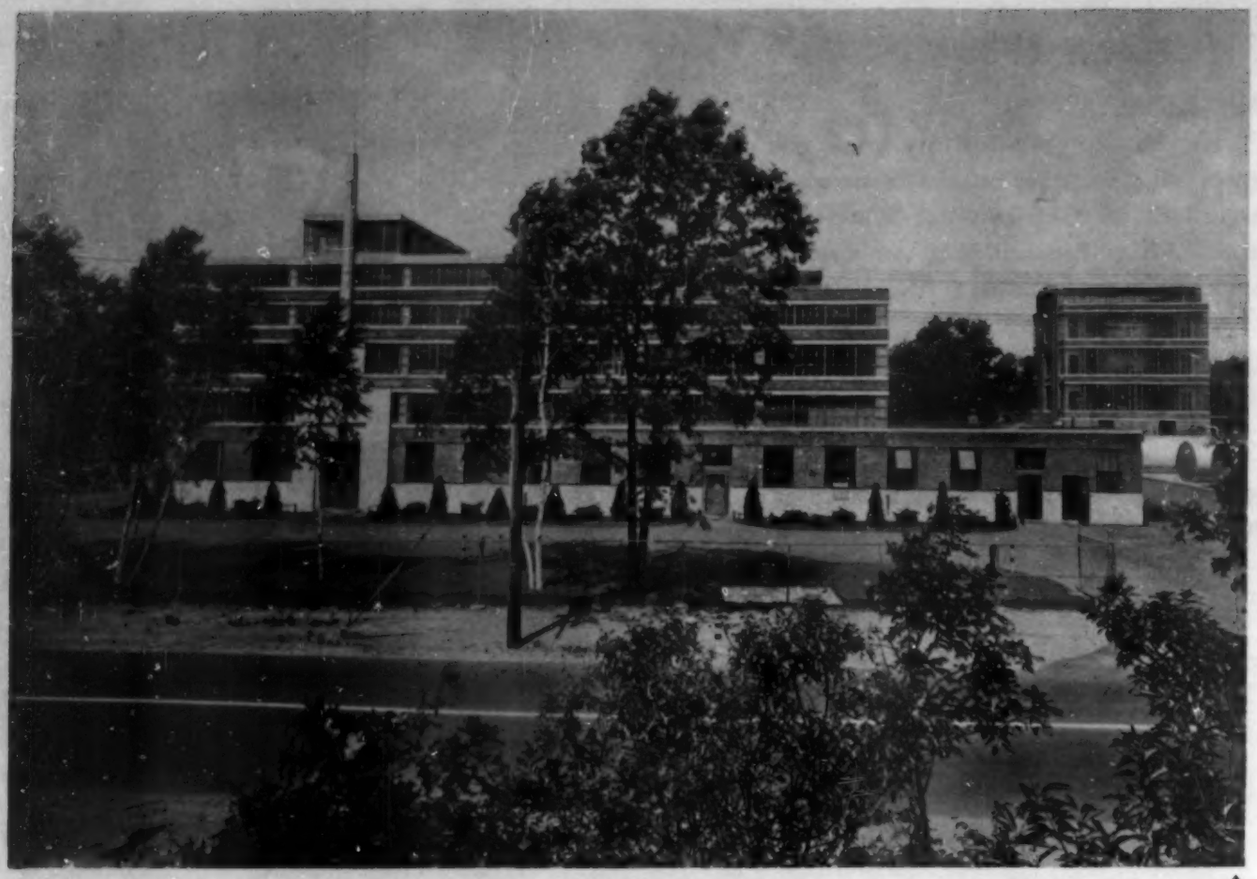
Formula for an attractive product: mold the case of gray Plaskon and put on a few small touches of scarlet Plaskon. The combination harmonizes with almost any household background. You can't go wrong.

Naturally, gray and scarlet is only one of hundreds of attractive color schemes, but on this General Electric range timer it's particularly good. It goes well with the white porcelain range, doesn't conflict with colored walls, and combines an efficient look with a dash of gayety. And when used on a simple, well-designed case like this, a good sales response is almost guaranteed.

General Electric's Plastic Department are the molders of this Plaskon timer housing.

For faster-selling plastic moldings, ask your molder to submit samples in Plaskon's rich appealing colors. For complete information on Plaskon properties, write Plaskon Co., 2121 Sylvan Avenue, Toledo, Ohio.

COMPANY INCORPORATED
TOLEDO, OHIO
INDUSTRIES LTD., MONTREAL, P.Q.



SAFETY GLASS GETS A BREAK

This is one of two new plants recently erected in the East to supply safety glass manufacturers with a new vinyl type resin in continuous sheet for laminating their product and improving its stability

VINYL ACETALS PROVIDE GLASS MANUFACturers with an improved laminating sheet for safety glass which is stronger at low temperatures than the cellulose acetate in common use for this purpose. Fifteen-gage sheets of the new resin are stronger than 25-gage sheets of cellulose acetate and because it is unaffected by moisture, the new resin requires no sealing at the edges of the glass; nor cement to make it adhere in laminating.

The pictures on this and the three following pages illustrate what happens when a new plastic reaches the stage of commercial production. They reveal the new plant of Shawinigan Resins Corp. recently erected at Indian Orchard, Mass., at a cost of nearly three-quarters of a million dollars. This company is a co-owned subsidiary of Monsanto Chemical Co. of St. Louis, Mo., and Shawinigan Chemicals, Ltd., Shawinigan Falls, Quebec. Situated on the bank of the Chicopee River, the new plant adjoins the Plastics Division of Monsanto where the resins are processed on continuous sheeting units for use in safety glass and other products now in the process of development in the research laboratories of Monsanto at Indian Orchard, Massachusetts and Dayton, Ohio.

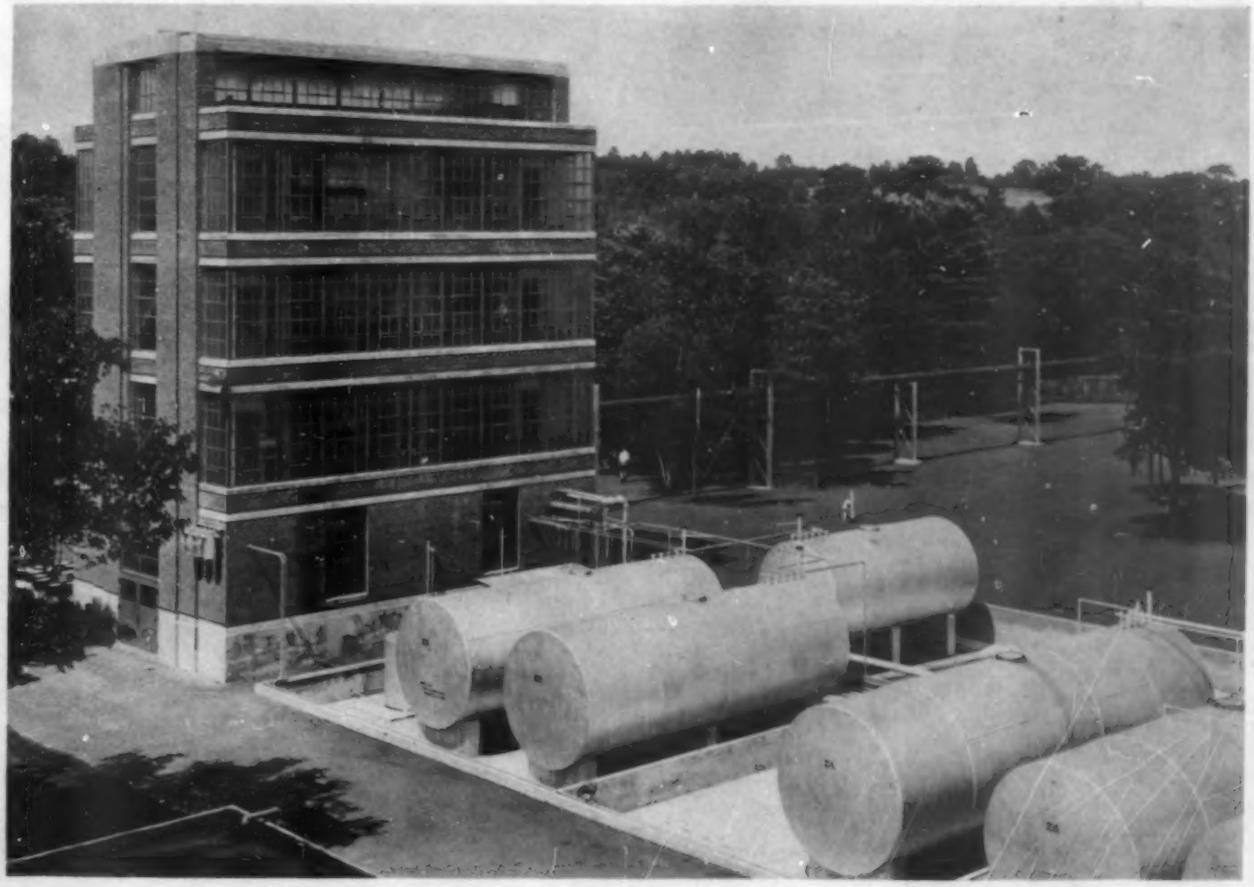
The capacity of the resin plant is ten to twelve thousand pounds per day, or sufficient resin to fabricate about fifty million square feet of safety glass plastic per year. This represents about half the current requirements of glass manufacturers.

Safety glass has probably contributed more toward safety in transportation than any other single discovery and the Indian Orchard organization now owned by Monsanto, was a pioneer in the development. It began with private automobiles, branched out to include buses, aircraft and railway trains. In the beginning, cellulose nitrate was used as the laminating medium. Later, it was found that cellulose acetate showed less tendency to "yellow" but use proved that moisture and cold weather sometimes caused delamination to take place. Vinyl acetals may not be the ultimate resins for safety glass manufacture but their superior physical properties place them far ahead of others at the present time.

B

Photographs on these two pages reveal the scope and equipment of the new vinyl acetal plant of Shawinigan Resins Corp. where this new safety glass plastic is being made. (A) Front view of the main buildings (B) Storage building, containing water filtration plant. Gasometer with tank storage and still house in the right foreground. (C) Close-up of tank storage and five-story still house. Additional pictures on following pages

C



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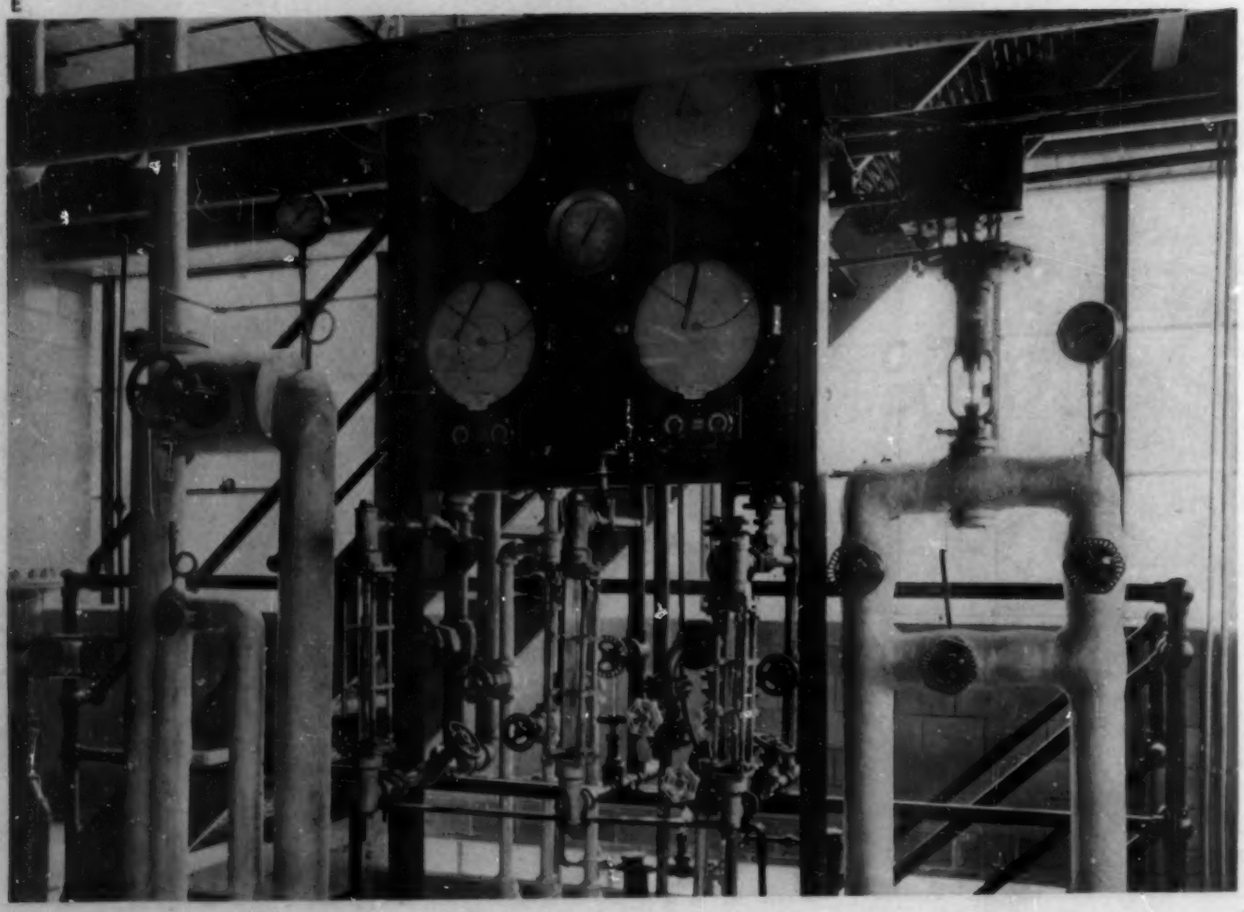
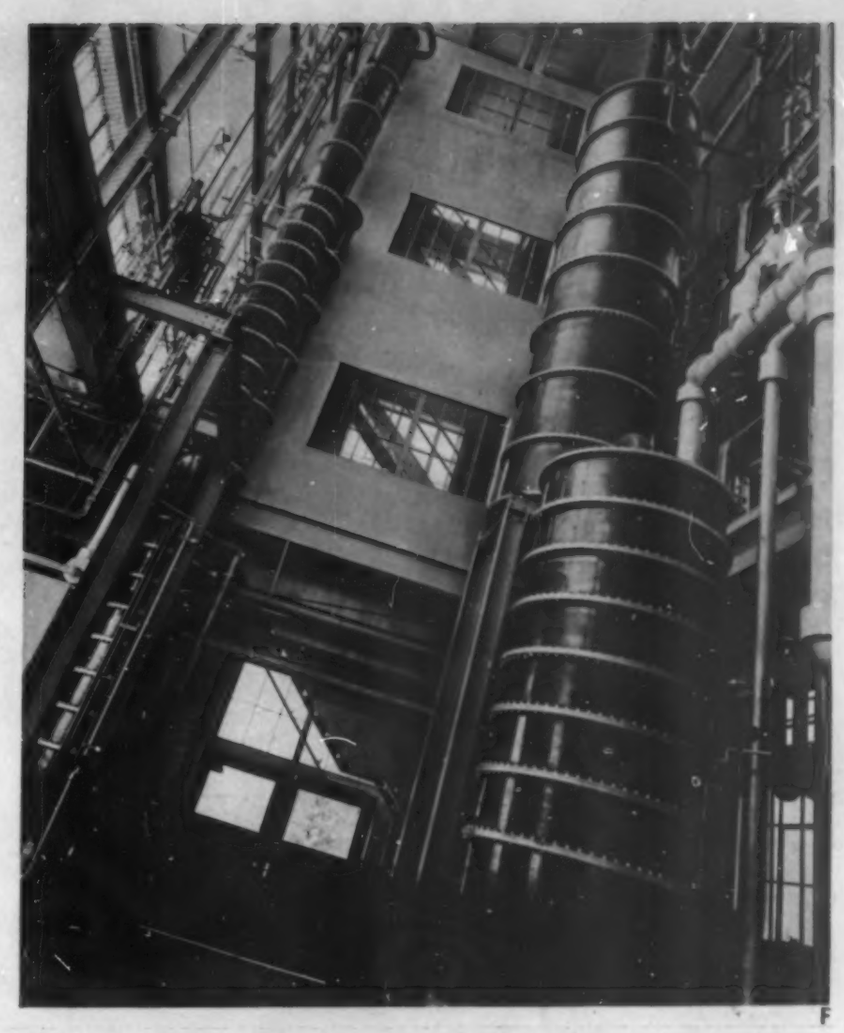
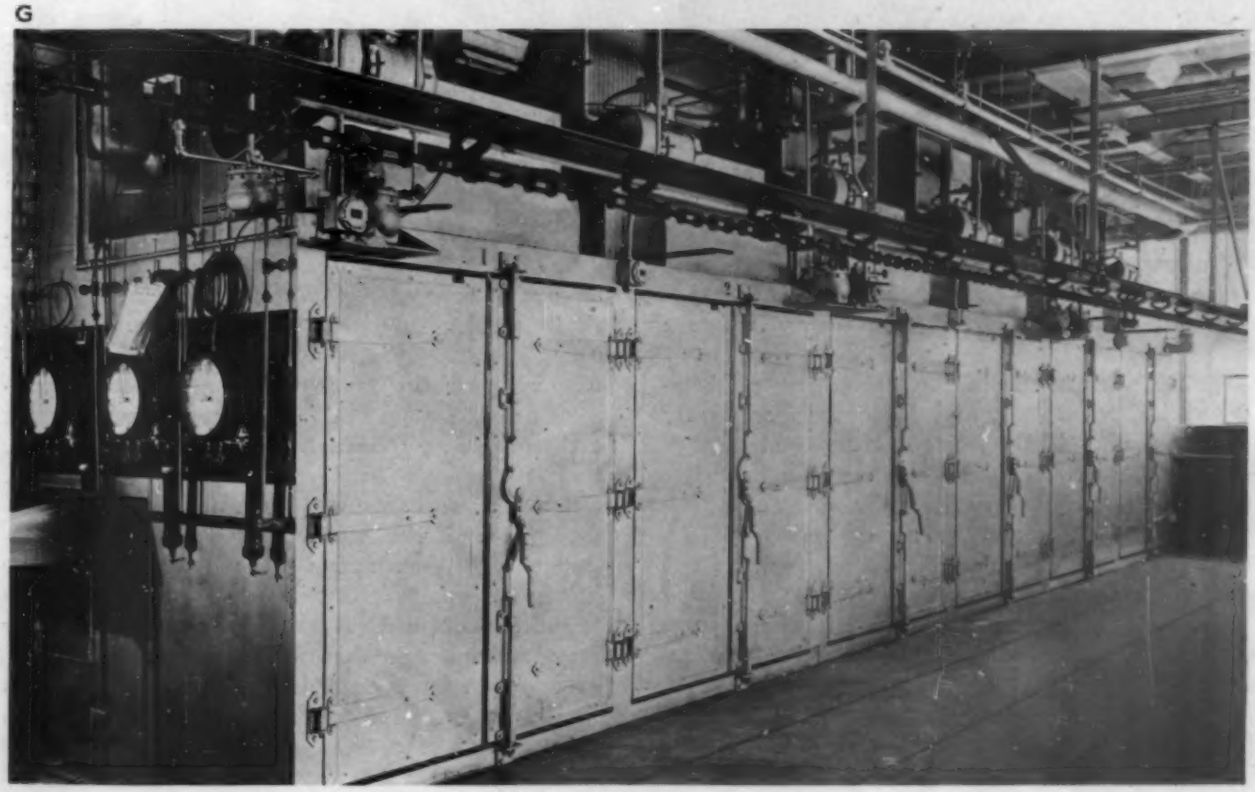




F

(D) Reaction kettles, in the Shawinigan Resin Corp. plant, and part of the wash tank equipment in which the resin is washed after precipitation. (E) Control panel for the vinyl acetate still. (F) Close-up of the alcohol recovery still in the still house. Still columns and condenser are all of copper. This picture also shows one of the enclosed fireproof stairways and balconies located at either end of the building which have emergency exits giving free escape from each of the five floors to the outside. (G) One of a battery of six driers in which the material is finally dried ready for packing and shipping in rolls of continuous sheeting. Other views of the plant appear on the preceding pages

G



PRECISION SHAPES

by J. EDWARD SCHIPPER[1]

Miniature sections made by new process find many uses—laboratory products now made available for industry

FIVE YEARS AGO A GERMAN CRAFTSMAN BY the name of Hermann Deutsch invented and perfected a machine capable of making useful forms and sections from standard extruded, round, square, hexagonal or other shape bar metal stock. Unlike sections made by the extrusion process, the new machine carries the work down to sizes so small as to be almost unbelievable yet with extreme precision. As a result these shapes can be made with wall thicknesses as thin as $1/64$ in. or even thinner if desired, while holding all operations to a maximum tolerance of .001 to .002 inch.

The Deutsch machine has been practically a laboratory curiosity until recently, being used mainly for scientific work. In the Julius Rosenwald Museum of Science and Industry in Chicago there are 20,000 feet of its product in use in various exhibits which have been made by this secret process, and many other scientific exhibits in America and Europe contain examples of this work. The latest development important to the plastic field, is that the rights for the Deutsch machine and its products, have been acquired by Precision Shapes, Incorporated, a new firm headed by Paul H. Fassnacht, now making these profiles available for commercial use. Radio and automobile manufacturers particularly have evinced a tremendous interest in these shapes as they provide decorative, as well as supporting and stiffening structures in many plastics installations which have heretofore presented practical difficulties.

The sections are available in brass and aluminum principally, but can also be had in gold, silver or copper. They can be produced in great quantities to meet the demands of industry at reasonable prices, and with an infinite range of angular geometric shapes which are practically without restriction. According to Mr. Fassnacht, almost any conceivable shape, design, wall thickness or angle of slots can be had. For automotive instrument panels, for metallic trim on radio sets, for clock dial figures, in fact for an endless variety of other purposes, these precision shapes may be anchored in the plastic material as a permanent part of the structure.

"It is very likely" says Mr. Fassnacht, "that the introduction of these shapes in small sizes which have hitherto been impossible will permit the use of plastics in entirely new fields, as well as making many of their present uses more satisfactory."

Some of the forms as indicated by the sectional cuts illustrated are highly decorative and of great value as a stiffening means. They give rigidity to the units in which they are used and (*Please turn to page 70*)

[1] Member S. A. E.

STOCK MOLDS

SHEET SIXTY-THREE

Handles of various shapes and sizes are available from stock molds

---

744. Stove handle 9 1/2 in. long. Contrasting color is wiped-in for decoration. Two threaded openings 3/16 in. in diameter for attaching

745. Stove handle 9 1/16 in. long with contrasting color decoration. Openings for attachment 3/16 in. in diameter

746. Stove handle 9 in. long with metal inlay. Four threaded openings 1/8 in. in diameter

747. Oven door handle 6 1/2 in. long with metal decoration. Threaded openings 1/8 in. diameter

748. Refrigerator handle 6 3/4 in. long with metal inlay and two stems for attachment with 1/8 in. opening

749. Stove handle 4 in. long with metal band and inlay. Brass insert 3/16 in. diameter

750. Dropped pendant handle 4 1/8 in. long with 3/4 in. opening at base. Set screw opening at side 3/16 inch

751. Drawer pull with metal inlay 2 in. long

752. Cutlery handle 3 1/4 in. long overall, 1/8 in. opening

753. Gas range handle with protruding stem 5/16 in. diameter. Length of knob 1 3/4 in.

754. Same as #753 with rectangular piece on stem and opening 1/8 in. in diameter

755. Tear drop knob 2 1/4 in. long, opening in center 3/16 in. diameter and opening at top for insert 1 3/8 in. long

756. Handle with fluted metal decoration 2 in. long and opening 1/4 in. diameter for attaching

757. Knob with metal band 7/8 in. long. Stem with 2 openings 1/8 in. diameter for attachment

758. Dropped pendant handle with contrasting color wiped in. 2 1/4 in. long D-opening 1/4 in. by 5/16 in.

759. Knob 2 in. long with metal band. D-opening with set screw

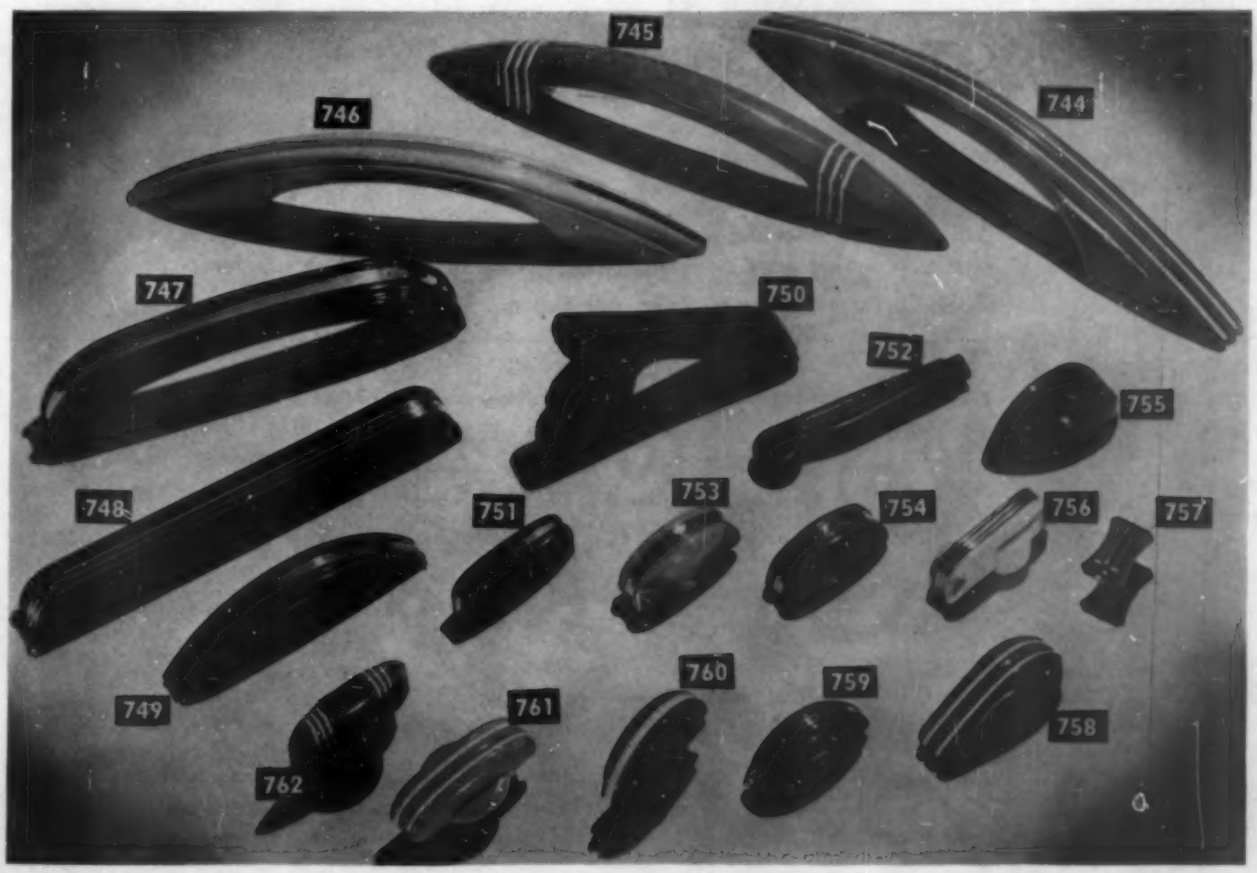
760. 3/16 in. brass insert in fan-shaped knob 2 1/8 in. long

761. 2 in. handle with stem 1/2 in. high

762. Handle 2 1/4 in. long with stem 1/2 in. high. D-opening with set screw

Address all inquiries to Stock Mold Department, Modern Plastics, 425 Fourth Avenue, N. Y. C. All molders are invited to send samples from stock molds to appear on this page as space permits

Reprints of sheets One to Fifty-Two—in book form, 25c in coin or stamps



STOCK MOLDS

SHEET SIXTY-FOUR

Advertising novelties and premiums available from stock molds. Interested executives should write on company letterhead when requesting samples.

Sheets One to Fifty-Two reprinted in book form, 25c in coin or stamps

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676. Ash tray with removable center plug for manufacturer's name. 2 11/16 in. inside diameter

677. Hinged box in contrasting colors 6 7/16 in. long., 3 3/16 in. wide; 2 in. high overall

678. Combination coaster and ash tray 5 1/4 in. long and 3 3/16 in. wide

679. Nest of ash trays with metal inlays, 2 3/4 in. diameter and 7/8 in. high

680. Cast resin ash tray available from stock with mirrored back. Scotties in contrasting colors are attached to the tray and provide the base

681. Cast resin pencil sharpener with scotties in contrasting colors forming sides and base

682. Molded Mah Jong characters with identifying marks wiped-in in contrasting color

683. Self-contained signature stamper 2 1/4 in. long

684. Cleaning pad container, for powder or cream rouge. Threaded base 2 1/8 in. diameter

Address all inquiries to Stock Mold Department, Modern Plastics, 425 Fourth Avenue, N. Y. C. All molders are invited to send samples from stock molds to appear on this page as space permits

SOYBEANS

by GEORGE H. BROTHER[1] and LEONARD L. McKINNEY[1]

Some possibilities in the production of protein plastic material from soybeans

THE SOYBEAN, IN A LARGE NUMBER OF VARIETIES, has been grown and utilized as a high protein, high fat foodstuff in the Orient, notably in China, Manchuria, and Japan for a period of some 5,000 years. It was introduced into the United States as early as 1804 (6), but until recently it has been grown in this country as a curiosity rather than for crop purposes. During the World War, interest in the soybean was aroused because of possible shortage of vegetable oils and by 1924 about 5,000,000 bushels were grown annually (4). In 1935 nearly 39,637,000 bushels were raised and harvested and approximately this production has been maintained since that year.

The principal interest has been in the oil which has found both industrial and food applications, while the meal has been largely used as a protein concentrate in mixed feeds for cattle, stock, and poultry. It was inevitable, however, that industrial interest should be aroused by solvent-extracted soybean meal, as it contains an average of from 40 to 50 percent protein. Some successful industrial non-food applications have been made with both the whole fat-free meal and with protein fractions produced from it. These include adhesives, especially for plywood manufacture, sizes and finishes, such as that used in the production of washable wall paper, cold water paints, and the like.

In 1917 Sadakichi Satow (7) patented processes for the production of protein plastic material from soybeans. He elaborated his method in 1920 (8), and further in 1921 (9) and 1923 (10). His processes consisted essentially in the glutinization of the soybean protein curd by means of acid or alkali in water solution, and working the glutinous mass with or without the addition of formaldehyde into the shape required, and drying. His processes are obviously what in the analogous early development of casein plastic material are known as "wet process" methods. The rather extravagant claims for his material, none of which have been substantiated, are to be found duplicated in the early casein plastics literature. No commercial production is known to have been made on the basis of Satow's work.

With the development of the dry process of manufacture and of the resulting casein plastic material as a practical article of commerce, attempts were made to substitute soybean protein for rennet casein, but without success. The soybean protein was found to soften and swell with water much more readily than rennet casein, so it did not fit into the extrusion nor the established hardening processes. By modifying these somewhat, it is possible to obtain a product, but, as is the case with a plastic similarly prepared with acid casein, it is inclined to be more brittle than the regular commercial casein plastic material.

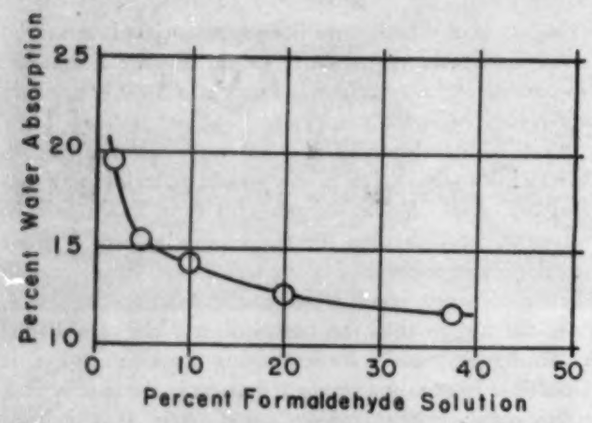
Soybean meal has found some industrial application mixed with wood flour, phenol, formaldehyde, lime, etc., in the production of a modified phenolic molding mixture (5, 11). So far as can be determined, it is the first and to date the only successful application of soybean meal or protein to the production of a commercial plastic material. Its function is definitely secondary, both the phenolic resin and the wood flour exceeding it in amount in the mixture, but there is little doubt that it modifies the plastic apparently favorably, as one concern has continued the use of this mixture for several years.

It has recently been shown that the plastic properties of soybean protein (1) at reduced water content, more nearly approaches those of a prolamine, such as zein derived from corn, than milk casein. This work was followed up by a study of soybean and other protein material hardened with aldehydes, especially formaldehyde, and it was found (2) that this formaldehyde-hardened protein material is thermoplastic. It was further found that the properties of the hardened thermoplastic protein vary with the pH at which it was hardened. If hardened at a pH within the isoelectric range of the protein, 4.1 to 4.3 in the case of soybean protein, a good plastic results which is free-flowing, clears the die read-

[1] U. S. Regional Soybean Industrial Products Laboratory, Urbana, Illinois. A co-operative organization participated in by the Bureaus of Chemistry and Soils and Plant Industry of the U. S. Department of Agriculture, and the Agricultural Experiment Stations of the North Central States of Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.

ily, is low in water absorption (less than in the average casein plastic material) and permanent. Protein hardened outside this range produces material which is more glutinous until that produced at either pH extreme can be cleared whole from the die only with difficulty. Water absorption increases with the glutinization as does the tendency to fracture spontaneously on drying. Satow's method produces this type of material.

The investigation of the effect of the pH of hardening on the resulting protein plastic was conducted with 40 percent formaldehyde (formalin) solution. In order to determine the effect of the concentration of the formaldehyde solution used in hardening, commercial soybean alpha protein was hardened by treatment with different concentrations of formaldehyde, all at a pH of 4.1 to 4.3, and the resulting plastics tested for water absorption exactly as was done in the previous investigations. The results are shown graphically in Figure 1. (Below)



The possibility of producing a thermoplastic material from protein that is hardened opens up a new field for the development of commercial protein plastic material. However, it was found that the hardening reaction of formaldehyde is not uniform for all protein material. Zein produced with formaldehyde a material inferior to the untreated zein, both as regards plastic properties and the water absorption of the plastic. Caseins did not produce as free-flowing a plastic material as did commercial soybean alpha protein. Of the rennet and self-soured caseins investigated, the acid casein produced the better plastic with a lower water absorption figure for a 24 hour test, namely, 10 percent as compared with 14 percent for the rennet casein. The difference between soybean proteins was even greater, the whole fat-free meal producing a formaldehyde hardened plastic which disintegrated in water before the end of 24 hours, while that produced from commercial soybean alpha protein showed but 10 percent absorption. Obviously, considerable work remains to be done in this field before any very definite statements can be made. The work as outlined here must be considered in the nature of preliminary investigations and the results obtained as indications to be subsequently substantiated or rejected.

In the investigation of the thermoplastic hardened protein mentioned above, 10 percent water content was found sufficient under the conditions of these experiments to render the formaldehyde-hardened soybean protein readily workable in the die, while the caseins required 15 percent and were not then as free-flowing. As indicated, the formaldehyde-hardened acid casein was more readily plastic than was the hardened rennet casein under the same conditions. In none of these experiments could the plastic flow be considered adequate for direct commercial molding. The molded pieces, however, came finished from the die, with a water absorption well under the average for commercial casein plastic material. They also showed less tendency to shrink and warp and were little more brittle, in spite of the fact that the powder had not been milled or worked previous to molding.

These results would tend to indicate that some work might advantageously be done to attempt the extrusion of formaldehyde-hardened soybean protein, to which sufficient water had been added to render it plastic enough to work through the extruder. In this way the material could be worked to materially increase its strength. The type of extruder intended is, of course, the cylinder press with the revolving worm, such as is employed in the rubber and casein plastics industries. The extruded material could be broken up and the resultant granular powder molded to shape in suitable dies. It would come finished from the die, unless more than about 10 percent water were present which would cause a certain amount of shrinkage. This would be considerably less than the average for casein plastic material, however, and long hardening treatment would not be necessary.

Another possible line of development is the examination of the thermoplastic hardened protein material containing reduced, rather than added water, for the purpose of finding a plasticizer or softener that would permit the development of a practical molding compound with it. If possible, this plasticizer should be water-repellent or react with the hardened protein to produce a water-repellent material. Over 70 different commercially available materials have been examined (3) in this way and some interesting data obtained. A completely satisfactory plasticizer was not found. Of those investigated, polyfunctional alcohols gave definitely positive results. Ethylene glycol produced the most plastic material, but it increased rather than decreased the water absorption in the material. Primary monohydric alcohols, esters, and oils gave negative results; polymerized soybean oil even rendered the material which was thermoplastic before the oil was mixed in, granular and non-thermoplastic.

The methyl and ethyl ethers of either ethylene or diethylene glycol in mixtures with the hardened soybean protein, produced plasticized material somewhat similar to that produced with ethylene glycol, but the butyl ethers of both ethylene and diethylene glycol gave negative results. Next to ethylene glycol, ethylene cyanhydrin gave the most interesting results. This work should be continued and the study made with some sort of flow testing machine, such as described by Gilbert L. Peakes

in Modern Plastics for February, March, and April 1934, and June 1937. No such machine was available for the investigation mentioned above, so the flow had to be gauged by the appearance of the plastic, its behavior in the die, and its water absorption.

There is evidence that a reaction may take place between the hardened soybean protein and ethylene glycol which is absorbed up to 35 percent by the protein with softening and swelling. If pressed, lower pressures are necessary for the high percentage ethylene glycol material, and a soft, rubbery plastic results. On aging, this material is slowly converted to a hard and more brittle material, yet there are no signs of the glycol exuding and with a boiling range of 374° F. to 400° F. there is not much probability of loss by evaporation. Furthermore, if a piece of the thermoplastic material containing the hardened soybean protein and ethylene glycol mixture is heated in the oven overnight at 212° F., the material will thermoset and be no longer thermoplastic. In the course of the development of a protein plastic material into a commercially practical molding compound, it may be advantageous to utilize this reaction and produce by means of it a thermosetting rather than a thermoplastic product.

Attempts were made in a few preliminary experiments to combine some other agent with ethylene glycol so as to improve the water resistance of the product while maintaining the free plastic flow. Of the agents tested oleanolic acid and aluminum stearate gave the most promising results. Two-tenths of one percent of the agent reduced the water absorption of the material about 15 to 30 percent. When it is considered that this plastic material was not milled and that the addition of ethylene glycol and the waterproofing agent were merely mixed in by hand in a mortar, it becomes quite evident that here is a line of research which may profitably be continued to greater lengths.

Having briefly described the development of a thermoplastic molding material from commercial soybean protein, it may be of interest to outline in detail the preparation of this product. The fundamentals of this development are covered by patent applications filed in the U. S. Patent Office and assigned to the Secretary of Agriculture from whom licenses may be obtained without royalty charges. One part of commercial soybean alpha protein was treated with two parts of 40 percent formaldehyde solution which had been adjusted to a pH of 4.1 ± 0.1 with caustic soda and allowed to stand at room temperature overnight. The excess formaldehyde was washed out with water and the hardened protein dried at 50° C. for 24 hours, or until the moisture content was reduced to 4–5 percent. If the excess formaldehyde is allowed to remain, the finished molded piece may craze on aging. This dried, hardened protein was then mixed with 20–30 percent ethylene glycol depending upon the degree of hardness desired in the final product. Two-tenths of one percent of oleanolic acid or aluminum stearate may be incorporated in this powder as a die lubricant and water repellent. A closed type or positive die is recommended. Heat may vary from

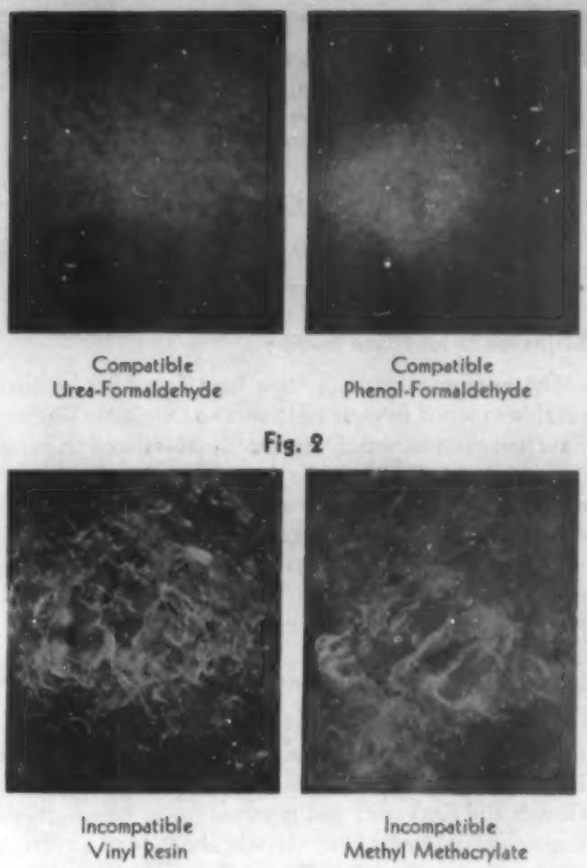


Fig. 2

Photomicrographs (32.5X) showing compatibility or incompatibility of thermoplastic formaldehyde-hardened soybean alpha protein with commercial molding compounds

212° F. to 350° F. and pressure from 2,000 pounds per square inch to 4,000 or 5,000, depending upon the time of pressing and the amount of ethylene glycol used, but in general 300° F. and a pressure of 2,000 pounds per square inch were found satisfactory for a pressing cycle of 3 minutes at 300° F. and 3 minutes to cool.

In order for soybean protein plastic material to fit very satisfactorily into the picture of the American molding trade as it is today, it will be necessary to either render the material much more thermoplastic or to control the thermosetting. In the first case, it must flow freely enough to be worked in injection molds, and in the second it must thermoset so as to permit removal from hot dies. From preliminary work, it would appear that either development is possible. The plastic flow is so definitely improved by the presence of ethylene glycol that more work conducted along this line has every assurance of success. On the other hand, the hardened protein ethylene glycol reaction appears to produce a thermosetting material. This reaction properly controlled can probably be utilized in the preparation of material which will thermoset in the die and can be removed without chilling under pressure.

It has long been recognized that protein material incorporated with other plastics (*Please turn to page 70*)

PLASTICS AS STRUCTURAL MATERIALS FOR AIRCRAFT[1]

by GORDON M. KLINE

National Bureau of Standards

Continued from the August issue

Resistance to long-time loading

The reinforced plastics have been found to be comparable to wood in their resistance to long-time loading. Experiments performed by the de Havilland Aircraft Corporation and reported by de Bruyne[3] showed that the endurance limit in tension of cord-reinforced plastic to continuous loading is approximately 75 percent of the strength under instantaneous loading. Graf[13] found that the static endurance of pine is about 60 percent of the strength as measured by short-time test.

Endurance limit for alternating loads

The endurance limit of fabric-reinforced plastic as determined by rotating beam tests is about 60 percent of the instantaneous static strength according to tests made by Gough and Cockcroft and reported by de Bruyne;[3] the limit observed by Kraemer[2] is only about 35 to 40 percent of the static strength. Parzich[13] found the torsional endurance limit to be 50 ± 10 percent of the static torsional strength. Riechers[6] discusses continuous bending tests of plastics in some detail and notes that more recent tests at the Technical School at Darmstadt gave endurance limits of 25 to 35 percent of the static tensile strength. De Bruyne[3] notes that the behavior of reinforced plastics in such tests is very different from that of metals because the specimen may continue to hold together for many millions of revolutions after a split has first appeared. The amorphous character of the material seems to prevent violently progressive crack formation.

Strength under repeated impact

De Bruyne[3] compared the behavior of specimens of the same size and shape of a cord-reinforced phenolic plastic and various alloys under repeated impact tensile loads, using an Amsler repeated impact testing machine. The strength values obtained for the plastic were quite comparable to those for the metals and indicated the ability of the cord-reinforced resin to resist shock.

Energy absorption

Measurements of the energy absorbed under torsional oscillation of various materials have been made by de Bruyne and Maas[14] and by Iobike and Sakai.[15] The results of these two investigations are summarized in Table 3. The ability of plastics to absorb energy would be of advantage in airplane construction in that undesirable and often dangerous resonance vibrations would be suppressed. Materials of high energy absorption may also be expected to resist impact better than those of low damping property since the energy of the blow can be used up not only in creating strain energy in the material but also in overcoming the internal friction. A material of high damping capacity is less sensitive to the effect of surface notches or sudden changes in cross section than a material with a small energy absorption. A disadvantage of excessive damping is the considerable internal heating which may occur and which should be investigated for materials intended for use as propellers.

TABLE 3. ENERGY ABSORPTION IN TORSIONAL OSCILLATION
(Data from de Bruyne and Maas[14] and Iobike and Sakai[15])

Material	Strain energy absorbed percent per cycle
Fabric-reinforced resin	24
Cord-reinforced resin	20
Paper-reinforced resin	18
Walnut	12
Zinc	12
Aluminum	1.10
Steel (0.55% carbon)	0.24
Steel (0.9% carbon)	0.17
Nickel	0.021

Flexural, shear and torsional strengths

Kraemer[2] made a detailed examination of the flexural, shear, and torsional strengths of various reinforced resins, wood, and plywood, with particular reference to direction of application of the stress relative to the principal fiber axis. The effects of variations in the thickness of the veneers, grain directions in the various layers, and the amount of compression of the wood were also investigated. The results of these tests are shown in Tables 4, 5, and 6 on the next following pages. Detailed results of other tests made with these same materials are included in the tables. The values for the fabric-reinforced and paper-reinforced resins differ to some extent from those given in Table 2, which is probably due both to differences in the samples and in testing methods.

Corrosion

The resistance of reinforced plastics to corrosion has been an important factor in promoting their extensive use for many industrial purposes. Kraemer[2] made a series of tests with phenolic resin products reinforced with paper and fabric. In aging tests out-of-doors, specimens of the fabric-filled material had undergone

[1] Paper presented at the Annual Meeting of the Institute of the Aeronautical Sciences, January 24, 1938. Publication approved by the Director of the National Bureau of Standards of the U. S. Department of Commerce.

TABLE 4. PROPERTIES OF PLASTICS, PLYWOOD, AND WOOD
(Adapted from Kraemer[3])

Property	Phenolic resin	Fabric-reinforced resin	Paper-reinforced resin	Birch plywood	Pine wood
Specific gravity (S.G.)	1.25–1.35	1.35	1.4	0.8	0.5
Tensile strength (T.S.), lb./sq. in.	2,850–5,700	10,000	24,000	13,100	14,200
T.S./S.G., lb./sq. in.	.....	7,400	17,100	16,400	28,400
Compressive strength (C.S.), lb./sq. in.	11,400–15,650	25,600	23,800	5,700	7,100
C.S./S.G., lb./sq. in.	.....	19,000	17,000	7,100	14,200
Flexural strength (F.S.), lb./sq. in.	5,000–7,800	20,300	42,700	11,400	11,400
F.S./S.G., lb./sq. in.	.....	15,100	30,500	14,200	22,800
Shear strength (S.S.), lb./sq. in.	3,550–4,250	12,900	18,500	2,850	850
S.S./S.G., lb./sq. in.	.....	9,600	13,200	3,550	1,700
Torsional strength (Tl.S.), lb./sq. in.	2,150–3,550	6,050	4,550	2,250	1,400
Tl.S./S.G., lb./sq. in.	.....	4,500	3,250	2,800	2,800
Repeated bending strength (R.B.S.), lb./sq. in.	1,150–1,400	3,550	7,100	4,250	4,250
R.B.S./S.G., lb./sq. in.	.....	2,600	5,050	5,300	8,500
Elastic modulus (E_t), lb./sq. in.	380,000–500,000	940,000	1,780,000	1,400,000	1,560,000
E_t/S.G., lb./sq. in.	.....	700,000	1,270,000	1,800,000	3,120,000
Shear modulus (E_s) lb./sq. in.	140,000–170,000	310,000	356,000	142,000	114,000
E_s/S.G., Lb./sq.	.....	230,000	254,000	177,000	228,000
Impact strength, ft. lb./sq. in.	1.9–3.7	21.4	25.1	9.3–23.3	23.3–46.5
Water absorption, % in 24 hrs.	0	0.5	0.85	45	ca. 50

TABLE 5. PHYSICAL PROPERTIES OF RESIN-IMPREGNATED PRESSED-WOOD, PLYWOOD, AND WOOD
(Adapted from Kraemer[3])

Property	Direction of test with respect to principal fiber axis	Plywood[a]	Resin-impregnated pressed-wood[b] Type I	Resin-impregnated pressed-wood[c] Type II	Resin-impregnated pressed-wood[d] Type III	Birch wood
Thickness, mm.		20	10	10	8	..
Specific gravity (S.G.)		1.00	1.21	1.27	1.15	0.67
Tensile strength (T.S.), lb./sq. in.	lengthwise	18,200	29,700	27,700	32,000	19,600
	crosswise	5,450	5,900	1,780	.....	1,070
T.S./S.G., lb./sq. in.	lengthwise	18,200	24,600	21,800	27,800	29,300
	crosswise	5,450	4,900	1,400	.....	1,600
Compressive strength (C.S.), lb./sq. in.	lengthwise	16,400	23,000	22,800	24,900	9,960
	crosswise	7,700	11,900	12,900	.....	1,280
C.S./S.G., lb./sq. in.	lengthwise	16,400	19,000	18,000	21,700	14,800
	crosswise	7,700	9,800	10,200	.....	1,900
Flexural strength (F.S.), lb./sq. in.	lengthwise	31,300	41,000	38,100	50,400	19,900
	crosswise	7,800	8,250	3,300	.....	1,400
F.S./S.G., lb./sq. in.	lengthwise	31,300	33,900	30,000	43,800	29,700
	crosswise	7,800	6,800	2,600	.....	2,100
Torsional strength (Tl.S.), lb./sq. in.	lengthwise	.....	4,400	5,150	.....	2,840
	crosswise	.....	4,200	3,600	.....	.....
Tl.S./S.G., lb./sq. in.	lengthwise	.....	3,650	4,050	.....	4,250
	crosswise	.....	3,450	2,850	.....	.....
Repeated bending strength (R.B.S.), lb./sq. in.	lengthwise	.....	.....	10,800	.....	4,980
R.B.S./S.G., lb./sq. in.	lengthwise	.....	.....	8,500	.....	7,450
Elastic modulus (E_t), lb./sq. in.	lengthwise	3,060,000	3,800,000	3,400,000	4,400,000	2,300,000
	crosswise	700,000	1,000,000	400,000	.....	83,000
E_t/S.G., lb./sq. in.	lengthwise	3,060,000	3,100,000	2,700,000	3,800,000	3,400,000
	crosswise	700,000	830,000	360,000	.....	120,000
Shear modulus (E_s), lb./sq. in.	lengthwise	215,000	220,000	210,000	.....	115,000
	crosswise	.....	175,000	.....	.....	.....
E_s/S.G., lb./sq. in.	lengthwise	215,000	180,000	160,000	.....	170,000
	crosswise	.....	145,000	.....	.....	.....
Impact strength, ft. lb./sq. in.	lengthwise	37.2–41.9	34.0–48.4	34.9–45.6	.....	55.8–65.1
	crosswise	7.0	2.8–5.6	1.4–2.1	.....	1.4–2.3
Water absorption, % in 24 hrs.		9.1	3.1	1.2	3.8	31.2

[a] Fifty layers of birch of 0.2–0.3 mm. thickness; 6 layers (every tenth) laid with grain crosswise to principal grain axis.

[b] Fifty layers of birch of 0.2–0.3 mm. thickness bonded under high pressure at 160° C.; 6 layers (every tenth) laid with grain crosswise to principal grain axis.

[c] Fifty layers of birch of 0.2–0.3 mm. thickness bonded under high pressure at 160° C. with grain in all layers laid parallel.

[d] One hundred layers of birch of 0.1 mm. thickness bonded under high pressure at 160° C. with grain in all layers laid parallel.

(Please turn to next page)

practically no loss in strength after 15 months. Thin paper-filled specimens 1 millimeter thick had frayed at the edges and showed a reduction in strength of 14 percent after 15 months. The originally smooth surface of the majority of the specimens had become matt after 6 months. Tests indicated that the flexibility of the specimens was not affected by exposure for 15 months. The resistance to salt water was determined by immersion for 8 months in a stirred 3-percent solution of common salt. Strength tests after 8 months showed that the paper-filled product had lost 12 percent of its original strength but that the fabric-filled material remained unchanged. There was practically no change in the appearance of the surfaces after being immersed in the salt solution for 8 months. Gasoline and oil had a negligible effect on the appearance and strength properties of plastics after a 10-day period of immersion. The maximum water absorption noted for a 24-hour period of immersion was 0.85 percent for paper-filled specimens. The reinforced phenolic plastics are difficult to ignite, and once ignited, burn relatively slowly and are readily extinguished by a slight draft. No results of tests on the stress corrosion of plastics have been reported, but it is probable that this effect is far less serious than for metals.

Fabrication

Four methods of joining various sections made of reinforced phenolic material have been suggested, namely, cementing, riveting, bolting, and keying by interlocking joints. The synthetic resin cements have better aging properties and moisture resistance than the protein glues heretofore employed by the aircraft industry. Joints can be made between laminated phenolic resin plastics that will have a strength of 2000 pounds per square inch or more, in shear. Greater strength may be achieved if the surface of the plastic is etched or sand-blasted so as to expose the fibrous reinforcing material to the action of the cement. With respect to the feasibility of riveting and bolting structures made up of reinforced phenolic plastic, de Bruyne[8] has reported the following values for the bearing strength of the cord-filled product:

Diameter of bolt inch	Bearing strength lbs./sq. in.
3/8	26,000
5/16	29,400
1/4	31,500
3/16	37,000

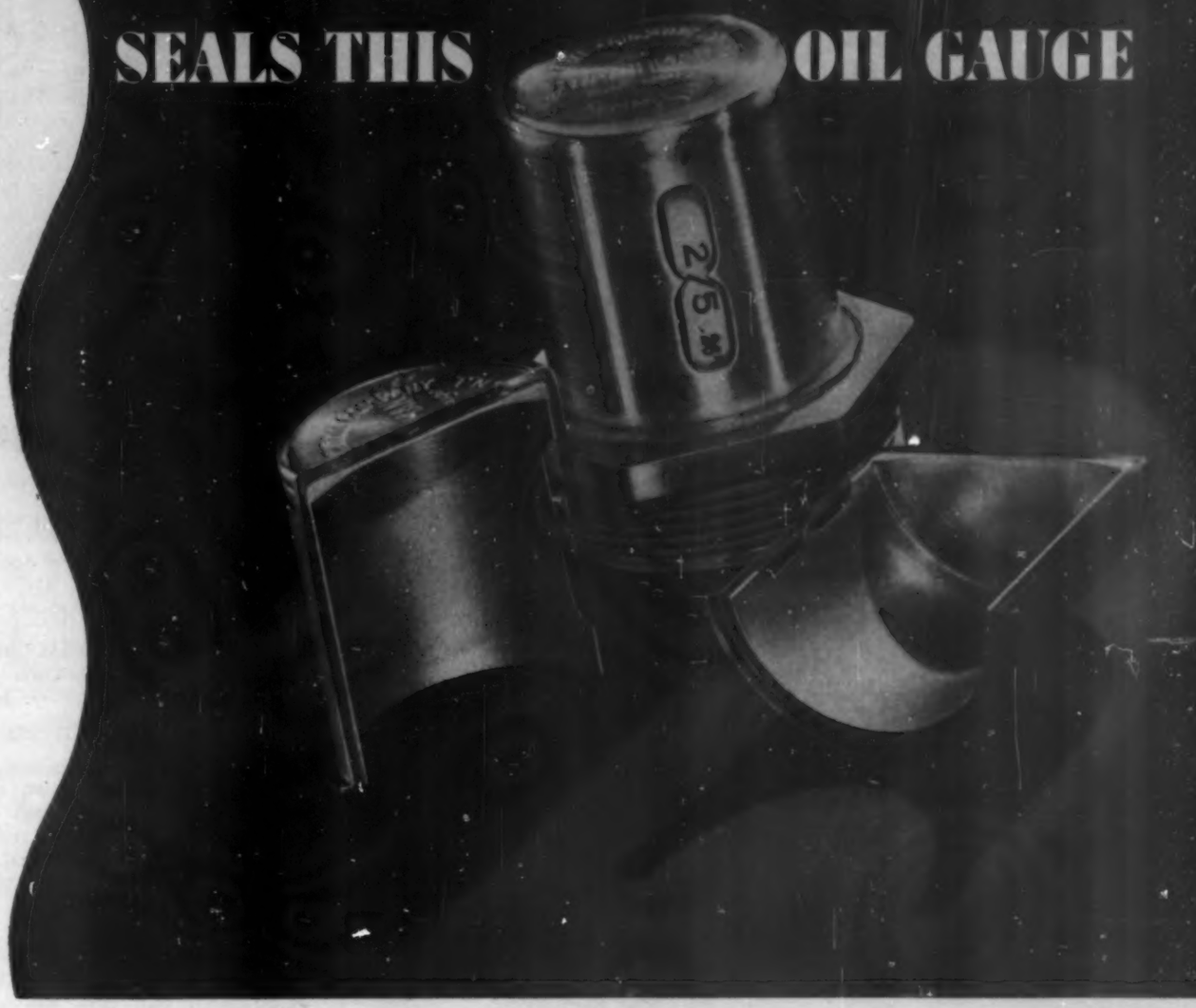
In general, the bearing strength of this material is more than five times that of spruce loaded parallel to the grain and thirty times that of spruce loaded perpendicular to the grain. Another factor involved in making riveted or bolted connections is the shearing strength. The low shearing strength of wood requires a large separation between the bolts. The greater shearing strength of the reinforced plastics permits a much closer spacing of the bolts. The method of keying by the use of interlocking joints has been used in metal aircraft construction and should also be applicable to structures made from reinforced resinous products. (*Please turn to page 66*)

TABLE 6. PROPERTIES OF RESIN-IMPREGNATED PLYWOOD
(Adapted from Kraemer[3])

Property	Direction of test with respect to principal fiber axis	Plywood[a]	Resin-impregnated plywood[b]	Resin-impregnated plywood[c] with fabric covering	Resin-impregnated plywood[d] with aluminum foil covering
Thickness, mm.		0.9	0.8	2.0	0.65
Specific gravity (S.G.)		0.80	1.19	1.29	1.31
Tensile strength (T.S.), lb./sq. in.	lengthwise	14,200	20,200	22,200	26,900
	crosswise	11,700	14,000	18,900	19,200
	diagonal	4,550	10,600	14,000	13,500
T.S./S.G., lb./sq. in.	lengthwise	17,700	17,000	17,200	20,500
	crosswise	14,600	11,800	14,700	14,700
	diagonal	5,700	8,900	10,900	10,300
Shear strength (S.S.), lb./sq. in.	lengthwise	2,850	6,400	8,050	.....
	crosswise	3,150	6,850	8,050	.....
	diagonal	5,000	8,250	9,900	.....
S.S./S.G., lb./sq. in.	lengthwise	3,550	5,400	6,250	.....
	crosswise	3,950	5,750	6,250	.....
	diagonal	6,250	6,950	7,700	.....
Elastic modulus (E_t), lb./sq. in.	lengthwise	1,780,000	3,560,000	2,350,000	.....
	crosswise	1,150,000	1,650,000	1,760,000	.....
	diagonal	430,000	940,000	1,000,000	.....
E_t/S.G., lb./sq. in.	lengthwise	2,200,000	2,990,000	1,820,000	.....
	crosswise	1,440,000	1,390,000	1,360,000	.....
	diagonal	540,000	790,000	770,000	.....
Water absorption, % in 24 hrs.		51.0	6.0	3.2	0.7

[a] Three layers of birch of 0.3 mm. thickness bonded with casein glue.
[b] Three layers of resin-impregnated birch of 0.3 mm. thickness bonded at 90° C.
[c] Five layers of resin-impregnated birch of 0.4 mm. thickness and surface coverings of fabric bonded at 90° C.
[d] Five layers of resin-impregnated birch of 0.15 mm. thickness and surface coverings of aluminum foil bonded at 90° C.

Transparent TENITE *molded over metal* SEALS THIS OIL GAUGE



Cross-sectional view and a complete assembly. Molded by Boonton Molding Co. for Liquid Level Indicator Co.

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PLASTICS DIGEST

This digest includes each month the more important articles (wherever published) which are of interest to those who make plastic materials or use them

General

THE APPROACH OF PLASTICS TO RUBBER. Harry Barron. Chem. and Ind. (London) *57*, 652–8 (July 9, 1938). The chemistry and physical properties of styrene, vinyl, acrylic, and methacrylic resins are discussed and the relation of these resins to rubber, rubber isomers and derivatives, and butadiene synthetics is considered. The author notes that synthetic elastic polymers have established themselves to some extent in almost every phase of rubber activity and that the probability exists that the market will be steadily widened until finally costs are lowered sufficiently to attack major rubber uses.

VINYARN AND ITS PROPERTIES. Rayon *19*, 370 (June 1938). The possibility that a synthetic resin may form the basis of a new class of synthetic yarns exists in "Vinyarn" which is spun from vinyl resin. It is said to have a true elasticity comparable to that of silk, to be resistant to water and low and high concentrations of mineral acids and alkalies, and to be nonflammable. Its production is still in an experimental stage and the yarn is not as yet commercially available.

CASTING AND CARVING PARTS FOR MODELS FROM PLASTICS. M. Jacker. Machinery *44*, 689–90 (June 1938). A composition consisting of equal parts by weight of paraffin, resin, and kaolin is suggested as suitable for many purposes. Where any considerable strength is required, sheets, rods, and tubes of commercial organic plastics can be readily worked.

CASEIN FIBER (LANITAL). H. G. Bodenbender. Textile Colorist *60*, 385–6 (June 1938), 451–2 (July 1938). The manufacture and properties of the synthetic fiber "Lanital" made from milk casein are described. The use of other protein materials for making textile fibers is also mentioned, for example, soy bean albumin in Japan and fish albumin in Germany.

Materials and manufacture

NOTES ON SOME FILLERS. British Plastics *10*, 76, 93 (July 1938). Some of the desirable properties of carbon black, slate dust, and diatomaceous earth for use in plastics are set forth.

GENERAL PROPERTIES OF PROTEINS. J. Delorme. Rev. Gén. Mat. Plastiques *14*, 187–92 (July 1938). A review of the classification, reactions, and properties of industrial proteins, some of which are used in commercial plastics. Not complete in this issue.

PROPERTIES OF STYRENE RESIN. Rev. Gén. Mat. Plastiques *14*, 150–6 (July 1938). Data on the electrical properties, heat conductivity, sound transmission, ultraviolet light absorption, resistance to water and chemical reagents, tensile strength, impact strength, indentation hardness, and abrasion resistance of styrene resin are cited, together with descriptions of the test methods. The measurements were made in two French national laboratories.

A NEW PROCESS FOR HARD LAC RESIN. P. Bhattacharya and B. S. Gidvani. London Shellac Research Bureau Tech. Paper No. 13 (May 1938). The treatment of lac with alkaline solutions (sodium carbonate, borax, and sodium dihydrogen phosphate) removes the more highly acidic components giving a commercial hard lac resin. The amount going into solution depends on the concentration of alkali and lac. The new process is simpler, more economical, and less hazardous than the use of organic solvents, and is also applicable to seedlac which cannot be treated with solvents because impurities promote polymerization at extraction temperatures.

MODIFICATION OF LAC WITH HIGHER FATTY ACIDS AND THEIR MIXED GLYCEROL ESTERS. PART II. P. Bhattacharya and B. S. Gidvani. London Shellac Research Bureau Tech. Paper No. 14 (June 1938).

Applications

EXPERIMENTS WITH MOLDED BEARINGS. Ernst Lehr. Kunststoffe *28*, 161–70 (July 1938). Extensive experiments with phenol and cresol resins and various fillers, including asbestos, shredded fibers, woven cotton fabrics, vulcanized fiber, and inorganic material, are described. The woven fabric rolled, hot-pressed, and subsequently heat treated to further harden the mass proved to be the most efficient material. Various recommendations are made for the preparation of the bearing and shaft, operating temperature, lubrication, and speed of rotation.

NEW ARMATURE BOARDS OF PLASTIC MATERIAL. British Plastics *10*, 78, 93 (July 1938). Various types of dashboards, representing the largest molded part in the automobile today, are described and illustrated.

PLASTICS FOR AIRCRAFT CONSTRUCTION. K. Riechers. Zeit. Vereines Deut. Ingenieure *82*, 665–71 (May 28, 1938). A review.

AMINO PLASTIC MOLDINGS FOR ELECTRICAL PURPOSES. E. E. Halls. Plastics *2*, 238–9 (July 1938). Two outstanding advantages of the amino plastic moldings are their permanence of color and their immunity from any tendency to track under damp conditions.

NON-TRACKING PLASTICS. P. Kemp. Elec. Review (London) *122*, 840 (June 10, 1938). It was only possible to produce conduction across the surface of urea moldings by severe arcing. The intense heat produced in this test was sufficient to burn away the end of the brass stud.

MICARTA PUMP RINGS REDUCE MAINTENANCE AT THREE ANTHRACITE COLLIERIES. W. E. Connor. Coal Age *43*, 884 (July 1938).

PHENOLIC-BASE MATERIAL USED FOR PICKLING TANK HOLD-DOWN ROLLS FOR STRIP STEEL. L. J. Owsley. Iron Age *141*, 91 (May 12, 1938).

PLASTICS IN DISPLAY. Walter Landauer. British Plastics *10*, 70–1 (July 1938). Opportunities for plastics in the fields of exhibition, and window and counter display are cited.

Testing

EXPANSION MEASUREMENTS ON PLASTICS. T. Gast. Zeit. Vereines Deut. Ingenieure *82*, 687 (May 28, 1938). Apparatus is described and illustrated for measurement of dimensional changes of plastics.

NEW COLD-TESTING APPARATUS FOR PLASTICS. Kunststoffe *28*, 171–2 (July 1938). Equipment for testing plastics at temperatures down to −40° F. is described.

TRADE NAMES AND INSPECTION MARKS OF GERMAN PLASTICS. Kunststoffe *28*, 182–87 (July 1938). Tabular information on the inspection marks assigned to each manufacturer and molder of plastics in Germany by the Government testing laboratory and the trade names of their products arranged according to the system of classification adopted by the trade in that country.

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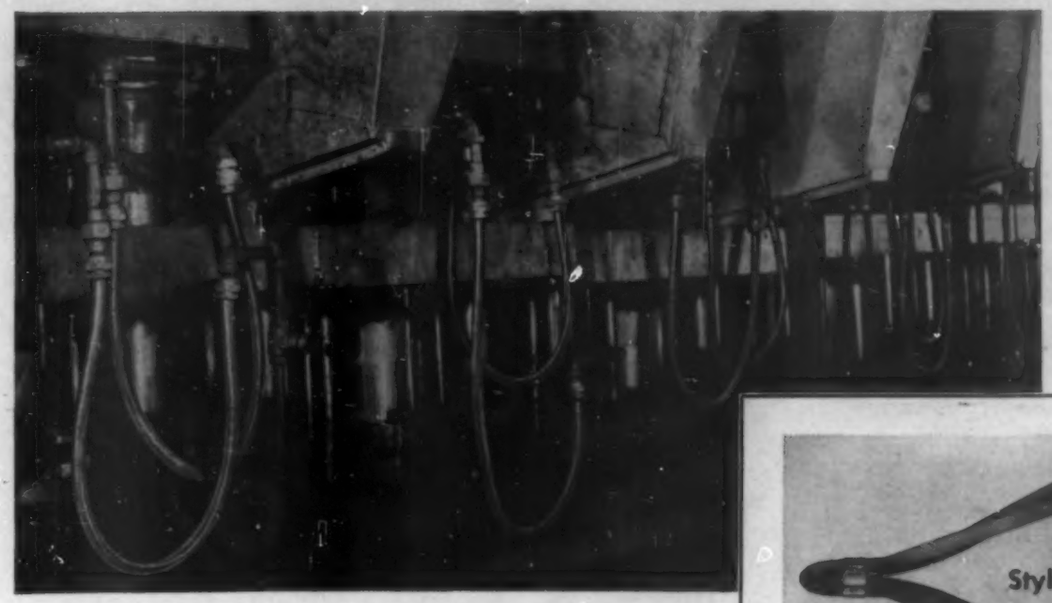

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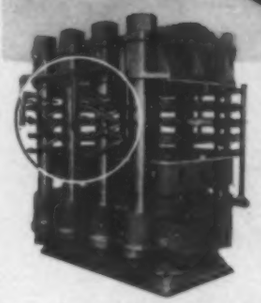

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U. S. PLASTICS PATENTS

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 10 cents each

BOTTLE SEALS. N. S. Frink; C. E. McManus; A. Weisenburg (to Crown Cork and Seal Co., Inc.). U. S. 2,121,791, 2,121,809, 2,121,810 and 2,121,844, June 28. Cork seals are made with a blended binder containing glue or casein and a natural or synthetic resin; or with a bodied tung oil binder compounded with glue or a resin; or with a binder containing a phenol-aldehyde and a urea-aldehyde resin plasticized with glycerol or diethyleneglycol.

METHACRYLATE RESIN. D. E. Strain (to E. I. du Pont de Nemours and Co.). U. S. 2,121,839, June 28. Making a light, fluffy powder of polymerized methyl methacrylate by dissolving the monomer in aqueous methanol and polymerizing, then separating the solvent from the powdery precipitate of insoluble polymer.

TREATING CELLULOSE ACETATE. H. A. Auden, H. P. Staudinger and P. Eaglesfield (to Ernst Berl). U. S. 2,121,899, June 28 Acetone-insoluble cellulose triacetate is rendered acetone-soluble by heating with isobutyl alcohol and an esterification catalyst, but in absence of acetylating agents.

PHENOLIC RESIN. Ignaz Kreidl. U. S. 2,121,917, June 28. Making phenol-aldehyde or cresol-aldehyde resins by alkaline condensation in presence of a sulphide condensing agent.

MOLDING. C. C. Jacobson (to John Robertson Co., Inc.). U. S. 2,121,966, June 28. Molding hardenable synthetic resins in rod or like form by extruding a sheath, extruding the rod of plastic inside the sheath, hardening the plastic so that it will retain its shape, and stripping off the sheath mold.

ALKYD RESINS. Werner Conrad (to Herbig : Haarhaus Aktiengesellschaft). U. S. 2,122,089, June 28. Alkyd resins are made with excess of glycerol and are modified with mono- or diglycerides of oil acids, saturated or unsaturated.

CABLE JOINTS. Ernst Studt (to Norddeutsche Seekabelwerke Aktiengesellschaft). U. S. 2,122,118, June 28. Cables insulated with a composition of deproteinized rubber, deresinified balata and wax have their joints covered with a thermoplastic mixture of gutta percha and polystyrene.

ORNAMENTAL RODS. J. H. Clewell (to E. I. du Pont de Nemours and Co.). U. S. 2,122,246, June 28. Rods with alternate nacreous and non-nacreous stripes running lengthwise are cut from blocks of plastics, alternately laminated, sliced and relaminated until longitudinal square prisms are formed with the two types of plastic alternating.

PIGMENTED RESINS. G. H. Wilder (to E. I. du Pont de Nemours and Co.). U. S. 2,122,270, June 28. Pigmenting a phenol-formaldehyde resin with calcium lactate by forming the resin in presence of calcium hydroxide, calcium carbonate and lactic acid, distilling off water and hardening the resin while precipitating the calcium lactate.

ACETAL RESIN. B. C. Bren (to E. I. du Pont de Nemours and Co.). U. S. 2,122,277, June 28. Making polyvinyl acetal resins by acid condensation of polyvinyl alcohol with an aldehyde and neutralizing the acid with an amine.

MOISTUREPROOF FOILS. F. M. Meigs (to E. I. du Pont de Nemours and Co.). U. S. 2,122,433, July 5. Moistureproofing foils by a surface coating joined to the foil by an alkylamine-phenol-aldehyde resin which is insoluble in water or dilute aqueous ammonia but soluble in dilute acetic acid.

COMPRESSIBLE ABRASIVE. J. N. Kuzmick and L. S. Hilton (to Raybestos-Manhattan, Inc.). U. S. 2,122,691, July 5. A solid, compressible abrasive article bonded with an interpolymer of chloroprene and a synthetic resin, the latter serving to reduce the stretch of the chloroprene.

NITROGENOUS RESIN. J. H. Balthis, Jr. (to E. I. du Pont de Nemours and Co.). U. S. 2,122,707, July 5. Making nitrogenous resins by reaction of a polyvinyl ketone with ammonia or a primary amine.

THERMOPLASTIC POLYMERS. C. Wulff and E. Dorrer (to I. G. Farbenindustrie Aktiengesellschaft). U. S. 2,122,805, July 5. Making solid vinyl polymer by heating monomeric compound, without solvent, below its boiling point but above 30° C. until the liquid solidifies.

BATCH POLYMERIZATION. B. M. Marks (to E. I. du Pont de Nemours and Co.). U. S. 2,122,886, July 5. Polymerizing acrylate or methacrylate esters in a batch process to form granular solid polymers, using an aqueous medium containing filtrate from a previous batch.

GREASEPROOF CONTAINER. Jose B. Calva (to General Products Corp.). U. S. 2,122,907, July 5. Greaseproofing containers by coating the inner surface with a film of glue-glycerol plastic hardened with formaldehyde.

WATERPROOF SANDPAPER. Fred G. Pellett (to General Electric Co.). U. S. 2,123,062, July 5. A waterproof binder for the layer of abrasive particles on paper for wet sanding comprises a reaction product of a drying oil modified alkyd resin and a phenol-aldehyde resin.

COMPOSITE MATERIAL. Frazier Groff (to Union Carbide and Carbon Corp.). U. S. 2,123,155, July 5. Making a composite material by firmly joining an infusible thermosetting resin to a vinyl resin through a thermosetting resinous bonding agent modified by addition of a resin to which the vinyl resin will adhere.

ALKYD RESINS. Paul Robinson (to E. I. du Pont de Nemours and Co.). U. S. 2,123,206, July 12. Making resins by alkaline alcoholysis of a drying or semidrying oil, and esterification of the product with a polybasic acid.

CABLE INSULATION. Helge Rost. U. S. 2,123,209, July 12. An insulating sleeve for electric conductors is made of a polyvinyl ester free from any added plasticizer, and is thin enough to be flexible.

KETONE RESINS. Wm. H. Moss (to Celanese Corp. of America). U. S. 2,123,249, July 12. Condensing methylethyl or methylbutyl ketone or cyclohexanone with a polyhydric phenol to form a resin.

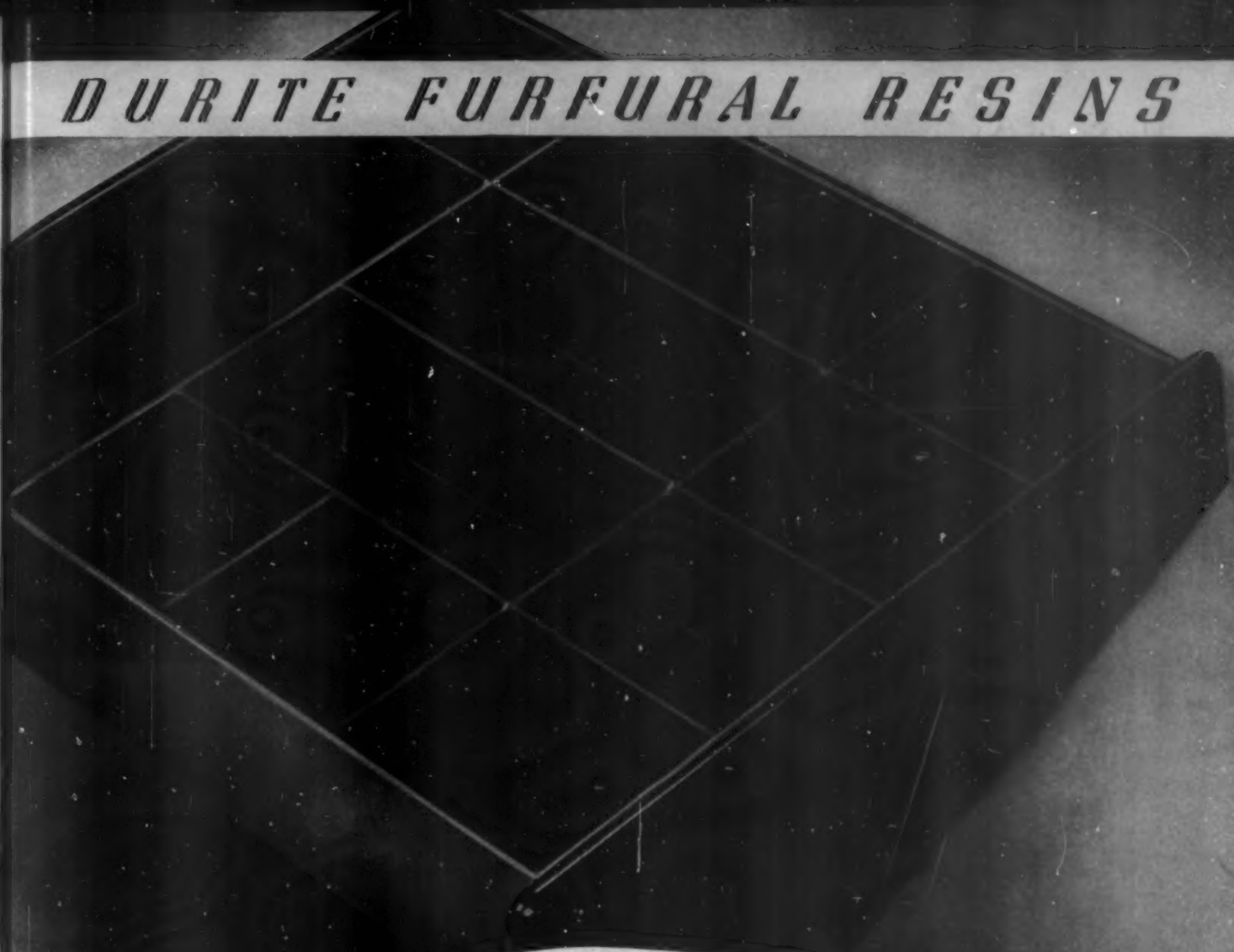
SAFETY HAT. J. B. Dym (to Mine Safety Appliances Co.). U. S. 2,123,275, July 12. A safety hat made of a molded plastic reinforced with a knit fabric.

CELLULOSIC PRODUCT. F. P. Alles (to E. I. du Pont de Nemours and Co.). U. S. 2,123,493, July 12. A flexible nonfibrous cellulosic composition made by action of an aldehyde on cellulose xanthate.

CHEWING GUM BASE. G. A. Hatherall (to Frank A. Garbutt). U. S. 2,123,531, July 12. Compounding a chewing gum base from a natural gum and an aromatic petroleum resin.

(Please turn to next page)

DURITE FURFURAL RESINS



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U. S. PLASTICS PATENTS

(Continued from preceding page)

SHEETING THERMOPLASTICS. E. L. Helwig (to Röhm and Haas Co.). U. S. 2,123,552, July 12. Apparatus for shaping organic thermoplastics in sheet form under fluid pressure with the aid of a mold which is movable within the pressure chamber.

IMPRESSION SHEET. Wm. M. Dalton. U. S. 2,123,564, July 12. Use of a celluloid impression sheet on the printing press platen in preparing makeready sheets for offset printing.

ACRYLIC ACID POLYMERS. H. Fikentscher and C. Heuck (to I. G. Farbenindustrie Aktiengesellschaft). U. S. 2,123,599, July 12. Emulsion polymerization of acrylonitrile or acrylate esters in presence of another film-forming material, in aqueous medium.

ALKYD RESIN. John H. Kelly, Jr. U. S. 2,123,605, July 12. An alkyd resin modified with a reaction complex made from rubber, resin, drying oil and unsaturated fatty acid.

SIZING FOILS. N. N. Kojevnikoff (to E. I. du Pont de Nemours and Co.). U. S. 2,123,700, July 12. A nonfibrous, nonporous but water-sensitive foil is sized with a cellulose derivative applied from an aqueous emulsion.

CABLE INSULATION. Helge Rost. U. S. 2,123,746, July 12. Cable insulation comprising closely joined successive layers of a solid organic polymer, each layer with a different dielectric constant from those of the other layers.

MOISTUREPROOF FOIL. D. C. Ellsworth (to E. I. du Pont de Nemours and Co.). U. S. 2,123,883, July 19. Wrapping foils made of low-substituted cellulose ethers are moistureproofed with a coating containing a wax and a film former which may be a cellulose derivative rubber or a synthetic resin.

PHENOL-TERPENE RESIN. H. Hönel and A. Zinke (to Helmuth Reichhold, Reichhold Chemicals). U. S. 2,123,898, July 19. Condensing a mono- or polyhydric mono- or polynuclear phenol with a halogenated terpene in presence of a condensing agent which is also a fixative for hydrogen halide.

LIGHT POLARIZER. E. H. Land (to Sheet Polarizer Co.). U. S. 2,123,901 and 2,123,902, July 19. Transparent sheets which polarize the light transmitted through them are made of a glass substitute, e. g., sheeted cellulose acetate-propionate, containing in suspension birefringent crystals such as potassium nitrate or urea.

SANDPAPER. R. P. Courtney (to Bakelite Corp.). U. S. 2,124,055, July 19. Making sandpaper by varnishing a fibrous base with a penetrating emulsion varnish, applying abrasive particles to the film and hardening the varnish.

UREA RESIN. H. S. Rothrock (to E. I. du Pont de Nemours and Co.). U. S. 2,124,151, July 19. Making a resin by noncatalytic condensation of urea with acetaldehyde or its higher homologs in alcohol solution.

LAMINATED MATERIAL. K. E. Prindle (to Dobeckmun Co.). U. S. 2,124,210, July 19. A decorative stitched sheet material with at least one layer of metal foil cemented with a transparent adhesive to a transparent rubber hydrohalide foil.

METAL FOIL. H. G. Kittredge and F. W. Williams (to Foilfilm, Inc.). U. S. 2,124,232, July 19. Coating metal foil with an alkyd resin, an arylsulphonamide-formaldehyde resin, lead linoleate and a wax.

SAFETY GLASS. M. Mueller-Cunradi, M. Otto, W. Daniel and R. Werner (to I. G. Farbenindustrie Aktiengesellschaft). U. S. 2,124,235, July 19. As a safety glass interlayer an isobutylene polymer having a molecular weight of at least about 1000.

VARNISH RESIN. Hans T. Bucherer. U. S. 2,124,285, July 19. A fast drying nongumming mixed ester resin for varnishes is made by esterifying a phenol-aldehyde resin with a mixture of linolic acid and rosin in the ratio 7 : 3.

FLAMEPROOFING. Herbert Dodd (to Imperial Chemical Industries, Ltd.). U. S. 2,124,288, July 19. A flame-resisting plastic composition contains chlorinated napthalene, chlorinated paraffin wax and a flameproofing agent.

PLASTIC. J. D. Ryan (to Libbey-Owens-Ford Glass Co.). U. S. 2,124,315, July 19. A polyvinyl acetal resin, formed from a saturated aldehyde and a partially or wholly hydrolyzed polyvinyl ester, and plasticized with an ester of adipic or a higher straight chain dicarboxylic acid.

COATED PAPER. T. A. Pascoe and R. P. Hella (to Cellovis, Inc.). U. S. 2,124,330, July 19. Paper pulp containing a cellulose derivative in dispersion is sheeted and the paper sheet is coated on both sides with a cellulose derivative solution so that the surface film is bonded to the cellulose derivative particles in the paper.

MOLDABLE RESIN. Josef Schmitz (to Resinous Products and Chemical Co.). U. S. 2,124,532, July 26. Phenol-aldehyde resins which contain no filler and can be molded to transparent articles are made by adding hexamethylenetetramine solution to a phenol-aldehyde condensation product, kneading at 100° C. to evaporate the solvent while hardening the resin, and stopping the operation when the product has a rubbery consistency.

CELLULOSE ETHER PLASTICS. E. C. Britton, S. L. Bass and E. G. Hallonquist (to Dow Chemical Co.). U. S. 2,124,540, July 26. Plasticizing water-insoluble cellulose ethers with xenyl phosphate to increase toughness and moisture resistance.

INTERPOLYMERS. Wm. M. Quattlebaum (to Union Carbide and Carbon Corp.). U. S. 2,124,630, July 26. Strong, tough resins are made by interpolymerization of vinyl chloride and vinyl acetate in presence of an oxygenated diolefin having 4 to 10 carbon atoms, its double bonds being neither conjugated nor cross-conjugated.

ABRASIVES. R. C. Benner and R. L. Melton (to Carborundum Co.). U. S. 2,124,666, July 26. Making abrasive coated products by applying to the backing an aqueous suspension of a solid phenolic resin and a sufficient quantity of abrasive grains, drying, and treating with a solvent which makes the resin adhesive.

POLYMERIZED ROSIN. A. L. Rummelsburg (to Hercules Powder Co.). U. S. 2,124,675, July 26. Raising the melting point of rosin, with no increase in acidity, by polymerization in presence of boron trifluoride.

PHONOGRAPH RECORD. W. O. Herrmann (to Alfred van Rapp). U. S. 2,124,701, July 26. Making phonograph records with a core composed of a high polymer resin, and playing faces composed of a blend containing a vinyl resin and an aldehyde resin.

IMITATION LEATHER FINISH. H. G. Kittredge (to New Wrinkle, Inc.). U. S. 2,124,703, July 26. An enamel which dries to a highly flexible wrinkle finish film, for use on imitation leather, contains a synthetic resin varnish, blended with an oil varnish and a small proportion of tung oil, together with drier, thinner, pigment and about 10% of a high boiling plasticizer.

CELLULOSE ESTER PLASTICS. L. W. A. Meyer (to Eastman Kodak Co.). U. S. 2,124,884, July 26. Plasticizing cellulose acetate with diethyleneglycol dipropionate or triethyleneglycol dipropionate.

DISGUISE MASKS. John W. Dawn. U. S. 2,124,767, July 26. A molding composition of plasticized hydrophilic colloid is compounded so that it melts between 70 and 80° C. and has suitable consistency and appearance for molding on the face in varying thickness, so that facial contours are changed.

(Please turn to next page)

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U. S. PLASTICS PATENTS

(Continued from preceding page)

LAMINATED PAPER. G. H. Mains (to Westinghouse Electric and Mfg. Co.). U. S. 2,125,076, July 26. Sheets of pigmented paper are impregnated with a moldable resinous binder, laminated and molded into a unitary structure.

LACQUER. Emile de Stubner. U. S. 2,125,103, July 26. Pigmenting a nitrocellulose lacquer base by kneading with unground pigment in a mixer in presence of a volatile nonaqueous solvent.

COATED FABRIC. C. B. Hall and J. D. McBurney (to E. I. du Pont de Nemours and Co.). U. S. 2,125,341, Aug. 2. Mirror finish coated fabrics are made by applying a plasticized cellulose derivative to a fabric base, coating a separate cellulose acetate foil with an adhesive and dusting with aluminum powder when nearly dry, then cementing the aluminum-coated foil to the coated fabric.

VINYL POLYMERS. W. O. Herrmann and W. Haehnel (to Chemische Forschungsgesellschaft G. m. b. H.). U. S. 2,125,374, Aug. 2. Modifying the viscosity of water solubility of polyvinyl alcohol or its partially hydrolyzed esters, ethers or acetals, by treatment with Congo red.

METAL FINISHES. M. W. Mason (to Pittsburgh Plate Glass Co.). U. S. 2,125,387, Aug. 2. Stable baking varnishes for protective coatings on ferrous metals (which ordinarily decompose the resin of the coating) are made by polymerizing vinyl chloride on the metal surface, which is previously phosphatized; the film is then baked.

NONLIFTING LACQUER. Chas. Bogin (to Commercial Solvents Corp.). U. S. 2,125,484, Aug. 2. Lifting of nitrocellulose lacquers containing drying oil modified synthetic resins is inhibited, long enough for applying a multiple coat system, by adding to the lacquer an antioxidant which prevents drying by oxidation while the successive coats are drying by solvent evaporation.

GLOSS FINISH. G. C. Tyce and V. Lefebure (to Imperial Chemical Industries, Ltd.). U. S. 2,125,527, Aug. 2. A gloss finish is applied to absorbent surfaces by coating with a resin emulsion, above the melting point of the resin but below the boiling point of the dispersion medium, drying the product and passing it through hot rolls.

CHEWING GUM BASE. G. A. Hatherell (to Frank A. Garbutt). U. S. 2,125,562, Aug. 2. A chewing gum base compounded from water, rubber and an aromatic petroleum resin.

FLOORING. Hugo Strauch (to I. G. Farbenindustrie Aktiengesellschaft). U. S. 2,125,594, Aug. 2. A floor or wall covering made from a pigmented aqueous solution of an ethylene oxide-castor oil condensation product, and a lacquer, drying oil or soft alkyd resin.

MOLDED HORN PRODUCTS. C. Ellis, Jr. (to Plaskon Co.). U. S. 2,125,776, Aug. 2. Condensation products derived from urea, aldehyde and horn are molded in a hot press in which projections on the plastic mesh with those on the mold, the horn imparting sufficient elasticity to permit removal of the hot molded articles without breaking them.

PRINTING ROLL. M. M. Safford (to General Electric Co.). U. S. 2,125,817, Aug. 2. The steel core of a printing roll is covered with a resilient, flexible, oilproof, inkproof alkyd resin derived from glycerol, phthalic anhydride, glycol and succinic acid.

COATING ARTICLES. V. H. Turkington (to Bakelite Corp.). U. S. 2,125,827, Aug. 2. Articles to be coated are passed through a liquid hardenable resin into an immiscible hot liquid on which the resin floats.

WALLBOARD. J. H. MacKenzie (to Marbon Corp.). U. S. 2,125,847, Aug. 2. Wallboard comprising a layer of fiber board containing a wood resin, laminated with a layer of a halogenated rubber composition.

HYDROCARBON RESIN. M. H. Arveson (to Standard Oil Co. of Indiana). U. S. 2,125,872, Aug. 9. Low temperature polymerization (below 0° F.). of liquid isobutylene in presence of butanes and normal butylenes, followed by heat treatment and recovery of the resinous polymer.

COVERING ARTICLES. Bjorn Andersen (to Celluloid Corp.). U. S. 2,125,874, Aug. 9. Rigid articles are covered by stretching around them a preformed cellulose derivative sheet, plasticized with a water-soluble plasticizer, and setting the sheet by leaching out the plasticizer.

ABRASIVE. R. S. Daniels (to Bakelite Corp.). U. S. 2,125,893, Aug. 9. Soft-bond abrasive shapes are made by mixing abrasive particles with a powdered alkyd resin, molding and baking.

FLAT FINISH. R. E. Parry (to Johns-Manville Corp.). U. S. 2,125,951, Aug. 9. A flatting agent for cellulose ester lacquers comprises diatomaceous earth, a small amount of water-soluble silicate and aluminum stearate to facilitate dispersion.

SAFETY GLASS. H. K. Nason (to Monsanto Chemical Co.). U. S. 2,126,028, Aug. 9. As a safety glass interlayer, a polyvinyl acetal resin plasticized with tributyl citrate.

PLASTICIZER. R. A. Jacobson (to E. I. du Pont de Nemours and Co.). U. S. 2,126,113, Aug. 9. Plasticizing cellulose derivatives with the carbamates of branched chain alcohols boiling between 135 and 250° C.

VINYL POLYMERS. F. W. Duggan (to Union Carbide and Carbon Corp.). U. S. 2,126,179, Aug. 9. Preventing discoloration of vinyl resins in the light, by adding an alkyl salicylate or derivative thereof.

GREASEPROOF GUMMED PAPER. F. W. Humphner (to Mid-States Gummed Paper Co.). U. S. 2,126,192, Aug. 9. Greaseproof adhesive paper is coated on one or both sides with a waterproof oilproof lacquer and one lacquered face is coated with a water-soluble adhesive.

VARNISH RESIN. M. J. Bonham (to McCloskey Varnish Co.). U. S. 2,126,242, Aug. 9. A clear homogeneous soluble varnish resin is made by condensing ester gum with monoglyceryl tungate and then with phthalic acid.

LEATHER FINISHES. H. Freudenberg and P. Haas (to Freudenberg und Co. G. m. b. H.). U. S. 2,126,321, Aug. 9. Coating leather with polyacrylate resins which dry to waterproof adherent elastic films without hardening the grain side of the leather.

FILM BACKING. P. C. Seel (to Eastman Kodak Co.). U. S. 2,126,350, Aug. 9. Backing paper for photographic roll films is coated with a layer of ethylcellulose (ethoxy content 49%).

CELLULOSE ACETATE VISCOSITY. C. J. Malm (to Eastman Kodak Co.). U. S. 2,126,488, and 2,126,489, Aug. 9. Increasing the viscosity of partially hydrolyzed cellulose acetate by adding a very dilute (0.0003 to 0.1%) aqueous solution of an alkaline earth salt; and decreasing the acetone viscosity of acetone-soluble cellulose acetate by thoroughly washing at least 4 times with distilled water.

TRANSPARENT FOILS. H. B. Smith (to Eastman Kodak Co.). U. S. 2,126,510, Aug. 9. Use of a lower alkyl myristate as plasticizer in transparent cellulose acetate-propionate, acetate-butyrate or acetate-stearate foils.

MOLDING COMPOSITION. C. Ellis (to Ellis-Foster Co.). U. S. 2,126,677, Aug. 9. Urea-aldehyde resin molding compositions reinforced with cellulose.

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FOREIGN PLASTICS PATENTS

Application dates are given for patents of European countries, but for Canada the issue date is given

METHACRYLATE RESINS. Du Pont Viscoloid Co. German P. 657,467, March 7, 1936. Polymerizing methacrylate esters, alone or mixed with fillers, polymerization accelerators, plasticizers and the like, by heating in a closed mixer under a reflux condenser, and masticating the polymer to a granular mass.

ELECTRIC CONDENSER. L. Linder (to Siemens & Halske Akt.-Ges.). German P. 657,080, March 18, 1934. A condenser is wound with at least one layer of a vinyl chloride or styrene resin and one or more supporting layers of paper, the resin being softened with a solvent or plasticizer or the vapor thereof before winding.

WATERPROOF SANDPAPER. Cie. Francaise pour l'Exploitation des Procedes Thomson-Houston. French P. 821,795, May 13, 1937. A flexible, waterproof abrasive paper or cloth has as its binder a blend of alkyd resin (modified with unsaturated fatty acids) and phenol-formaldehyde resin.

SYNTHETIC RESIN FIBERS. I. G. Farbenindustrie Akt.-Ges. French P. 823,645, June 28, 1937. Making elastic threads from thermoplastic vinyl resins such as after-chlorinated polyvinyl chloride, polystyrene, polyacrylate compounds or polyvinylcarbazole.

PLAYING CARDS. Bent Panker. French P. 823,898, July 3, 1937. Laminated paper playing cards are impregnated with a synthetic resin, hot-pressed to harden the resin, and coated with a phenol-aldehyde resin solution, pigmented with titanium dioxide.

VINYL POLYMER. W. Reppe, H. Ufer and E. Kuehn (to I. G. Farbenindustrie Akt.-Ges.). Can. P. 373,891, May 24, 1938. Polymerizing a vinylalkyl sulphide in presence of sulphur dioxide.

BINDER FOR PLASTICS. Mead Corp. British P. 476,344, June 19, 1936. A binder for use in molding compositions is made of pure, ash-free lignin (from pulp digesters), a phenol-aldehyde or urea-aldehyde resin or cellulose acetate, and a filler such as wood flour, asbestos, linters or reclaimed tire fabric.

ELONGATED SHAPES. Du Pont Viscoloid Co. British P. 477,364, June 26, 1936. Polymerizing a sirup of methyl methacrylate or of styrene in a metal mold in which the heating zone is advanced progressively along the mold and the solid polymer is released by shrinkage (either by further heating or by chilling) so that the elongated article can be easily removed from the mold.

ABRASIVE WHEELS. Norton Grinding Wheel Co., Ltd. British P. 478,028, Dec. 15, 1936. Molding grinding wheels around a center made from two aluminum disks joined by a synthetic resin bonding agent and a layer of cloth or perforated metal reinforcement, the reinforcement and bonding agent being carried from the center into the outer ring of bonded abrasive particles.

BRONZE FINISH. J. F. Hofmann (to Acme White Lead and Color Works). Can. P. 374,192, June 7, 1938. Synthetic resin varnish pigmented with an extremely fine nonleafing bronze powder and thinned with a highly volatile solvent.

RUBBER HYDROCHLORIDE. H. A. Winkelmann (to Marbon Corp.). Can. P. 374,232, June 7, 1938. Making a homogeneous, stabilized thermoplastic molding composition by milling rubber hydrochloride with magnesium oxide.

VINYL RESIN PLASTICS. Chemische Forschungsgesellschaft. German P. 658,507, March 1, 1934. Making plastics by interpolymerization of vinyl esters and acrylate esters, or by polymerizing the components separately and mixing the polymers.

SAFETY GLASS. Societe Generale d'Optique S. A. des Anciens Etablissements Huet et Cie. German P. 658,565, Dec. 4, 1933. In making safety glass the glass sheets are fixed in a vertical position and the viscous, transparent interlayer is introduced into the intervening space under vacuum, rising from the bottom to the top.

AMINE RESINS. Gesellschaft für Chemische Industrie in Basel. German P. 658,485, Feb. 8, 1932. Making hardened, infusible resins by condensing binuclear or polynuclear aromatic amines or hydroxyamines with aldehydes, prehardening the product at a moderate temperature and finally hardening under heat and pressure.

RUBBER DERIVATIVES. Wingfoot Corp. British P. 479,464, Aug. 7, 1936. Thin, flexible rubber hydrochloride foils are plasticized with butyl or amyl stearate, dibutyl or diphenyl phthalate, phenyl thiophosphate, tributyl phosphate, dibutyl tartrate or like esters.

HIGH POLYMERS IN RUBBER. Standard Oil Development Co. British P. 479,478, Oct. 17, 1936. Compounding rubber (natural or synthetic) or a synthetic resin such as polyvinyl chloride or polyvinyl acetate with a very high polymer of isobutylene or isoamylene, i.e., a polymer having a molecular weight above 30,000.

FOILS. Celluloid Corp. British P. 479,508, May 2, 1936. Cementing nitrocellulose and cellulose acetate foils together with a cement containing dimethyl phthalate, ethyleneglycol monoethyl ether acetate and ethyl alcohol.

FLEXIBLE LACQUER. N. V. Vereenigd Industrieel Bezit Veritex. Holland P. 42,445, April 17, 1936. A finish for flexible materials is applied in 3 coats: 1) aqueous rubber dispersion 100, polyacrylic acid solution 200, cellulose ether emulsion 40 parts; 2) same ingredients but 100, 575 and 115 parts respectively; 3) a pigmented cellulosic lacquer.

FOILS AND TUBING. Deutsche Celluloid-Fabrik. French P. 822,742, June 7, 1937. Coagulation of cellulose or its derivatives, or of vinyl resins, from solution to make foils, filaments or tubing is accelerated by adding acetic, butyric, benzoic, cinnamic, oxalic or like acids, e. g., 4-minute coagulation of nitrocellulose with the aid of succinic acid.

CABLE INSULATION. L. G. Brazier, G. M. Hamilton and R. S. Vincent (to Callenders Cable & Construction Co., Ltd.). Australian P. 102,360, Dec. 8, 1936. To prevent formation of voids between conductor and insulation and between insulating layers in electric cables the spaces are filled with a plastic which will not creep as the temperature fluctuates. Phenol-aldehyde resins, polystyrene, polyacrylate resins, shellac and cellulose derivatives are among the suitable plastics.

POLYSTYRENE TUBING. Ernst Studt (to Norddeutsche Seekabelwerke Akt.-Ges. German P. 655,013, May 30, 1934. In making flexible tubing, tape or foils from polystyrene a tube is extruded and is at once expanded more than 30% in diameter by compressed air, while at the same time tension is applied to stretch the tube in length.

ELECTRICALLY HEATED SAFETY GLASS. Glas- und Spiegelmanufaktur M. Kinon. German P. 658,852, Feb. 3, 1936. Safety glass has resistance wire embedded in the plastic interlayer so that the glass can be kept warm electrically.

PRINTED FOILS. Nestle and Anglo-Swiss Condensed Milk Co., Ltd. German P. 658,578, Aug. 31, 1936. Wrapping foils are printed in special color effects by lacquering in the desired pattern with a lacquer containing a heat-hardenable resin, heating to the hardening temperature and applying a cellulose derivative lacquer, which is later removed from the printed or the unprinted area, according to the effect desired.

OPPORTUNITY IN BRAZIL

by Trade Commissioner
J. WINDSOR IVES,
Rio de Janeiro

There appears to be a large demand in Brazil for plastic material of various types which has increased steadily since 1934 and promises to enjoy an even heavier demand in years to come. By way of background information it might be mentioned that prior to 1934 it was a virtual impossibility to import plastic materials into this market due to excessive import duties. The new tariff which went into effect during that year provided for more favorable customs treatment of this material. As a result of this situation there has been an appreciable development in the molding industry in Brazil, which has brought with it a heavy demand for thermoplastic materials of various types. Duties on finished products are about three times those on raw materials.

Investigation reveals the fact that there are currently about 40 firms engaged in molding plastic materials in Brazil of which 30 are located in the City of Sao Paulo and 10 in the Federal District. The bulk of the production of these establishments is accounted for by caps and lids for bottles and jars used by local pharmaceutical and cosmetic industries. A certain volume of ashtrays, cigarette cases, and other articles are produced, although the difficulty of obtaining suitable molds has tended to restrict production of more complicated items.

According to information obtained from several of the larger local users of lids and bottle caps, the quality of the locally made product is poor due to the fact that molds are not properly made and many of the manufacturers mix imported plastic materials with casein and other materials which tend to make the finished product inferior.

Despite the poor quality of the bulk of the locally made caps and lids, they seem to be suitable for the requirements of local laboratories producing low-priced cosmetics, toilet preparations and pharmaceutical specialties. The larger foreign laboratories have been unable to obtain suitable caps and lids from local sources, with the result that they are obliged to import their requirements. These firms, whose annual cap and lid requirements are unusually large, would be glad to obtain these items from local sources if the quality would conform with their more discriminating packing standards.

Data regarding the amount of plastic materials consumed in Brazil are not available but it is believed that the annual purchases from abroad are substantial. There should be an excellent opportunity in Brazil, for the sale of molding materials by any American firm which would be in a position to give local manufacturing molding service. It is believed that if American firms would study competitive conditions in Brazil and the needs of this area, they would be in a position to participate more largely in the Brazilian market.

Admitting that "perfect" is a mighty strong word, the fact remains that perfect molded parts for their circuit breaker is exactly what Kurz-Kasch is delivering to the Frank Adams Electric Company, St. Louis, Mo.

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NEWS

ONE OF THE PRINCIPAL ATTRACTIONS AT THE RECENT EXhibit of machine tools and metal working equipment in the Boston Garden Exhibition Hall was the display of H-P-M Hydro-Power Presses, built by The Hydraulic Press Manufacturing Company, Mount Gilead, Ohio, which occupied a large section of the exhibition space.

THE R. D. WOOD COMPANY, PHILADELPHIA, ANNOUNCE THE appointment of Chas. C. Grant, 436 Second National Building, Akron, Ohio, as their exclusive agent for the Cleveland—Akron—Northern Ohio district.

THE NEW PLANT OF THE CHICAGO MOLDED PRODUCTS Corp., which will occupy 2½ acres and will cost in excess of $250,000, is now under construction at 1020 No. Kolmar Ave. at Augusta Blvd., Chicago. The steel has been erected; the masonry is nearly completed and the building will soon be under its permanent roof. It is expected that at least one section of the plant will be occupied by October 1st and the plant will be in full operation by early December. Pictures and complete description will appear in our January issue.

RETAINING ALL THE ADVANTAGES OF NEON BUT NOT requiring the formation of letters and words in a continuous line, a new system of wireless tube lighting for the advertising sign and display field has been introduced by Lustron Lights, Inc., 114 East 32nd Street, New York City.

No wires, plugs or sockets are needed to connect the tubes to the source of power which is a radio frequency oscillator built in a compact container unit. The unit is simply installed by being plugged into any 110V-AC outlet. The individual letters are interchangeable and can be arranged and lighted individually and may be as much as two feet from the power unit, thus eliminating unsightly cross-overs and doublebacks, and are mounted on Catalin backgrounds. The new system can be used for small signs, bulletin boards, countertops, show cases and show windows, as well as for marquees, theatres, department stores and in combination with large outdoor signs and are almost magical in their ability to receive power without physical connection over a two foot span of thin air. Leo Beck who developed these new tube lights was formerly with the Catalin Corporation and is now vice-president of Lustron Lights, Inc.

A SYMPOSIUM ON RUBBER WILL BE SPONSORED BY THE COMmittee on Rubber and Plastics at the Fall Meeting of the American Society of Mechanical Engineers, to be held at the Providence-Biltmore Hotel, Providence, R.I.—Oct. 5-7. The papers to be presented at this meeting will particularly emphasize mechanical problems in the production and use of rubber. These are: *Session 1* October 5—9:30 A.M. 1. The Engineering History of Rubber, by Dr. W. C. Geer, Ithaca, N.Y. 2. Synthetic Substances with Rubber-like Properties, by E. R. Bridgwater, E. I. du Pont de Nemours & Co., Wilmington, Del. *Session 2* October 5—2:00 P.M. 1. Problems in the Production of Rubber, by E. G. Kimmich, Goodyear Tire and Rubber Co., Akron, O. 2. The Mechanical Characteristics of Rubber, by F. L. Haushalter, B. F. Goodrich Co., Akron, O.

The Committee on Rubber and Plastics will meet in the evening of Oct. 5 to discuss projects for 1939 and 1940. Technical representatives of companies engaged in either the production or use of rubber and plastics are invited to attend. On the afternoon of Oct. 6, following the second session, A.S.M.E. members and visitors at the convention will be entertained with an inspection trip through the Providence plant of the U. S. Rubber Co.

SO THAT THEIR CANADIAN CUSTOMERS MAY ENJOY THE benefits of a resident office, Celluloid Corporation announces the appointment as agents for Canada, effective September 1st, Plastic Industries Ltd., 637 Craig Street, West, Montreal, Quebec, Canada.

"EXTON," A NEW BRISTLING FILAMENT FOR USE IN TOILET brushes, was announced recently by the Plastics Department of E. I. du Pont de Nemours & Company. The present production is limited and the entire output is being used in du Pont's own tooth brush manufacture. Varied and intensive experiments over the past two years have shown that the new synthetic product is superior in appearance and has much longer life than the natural bristle.

THEODORE P. WALKER, PRESIDENT OF COMMERCIAL SOLvents Corporation, announced recently the election of Samuel M. Greer and Linus C. Coggan to the board of directors of the corporation. Mr. Greer was elected to fill the vacancy in the directorate caused by the death of William D. Ticknor, president of Commercial Solvents Corporation. Mr. Greer is director of American Steel Foundries and Servel, Inc., and, for many years, he was an officer of the Bell Telephone System.

LINE CUTS USING TENITE, A CELLULOSE PLASTIC, INSTEAD of the customary zinc and other metals are being made by Economy Plate Co., 22 West 21st St., New York City. Economies up to 50 percent are reported by label manufacturers and others in their cost of printing plates using this material. Service is prompt and the plates stand up successfully in runs of 100,000 and more due to the resilience and toughness of the cellulose acetate material.

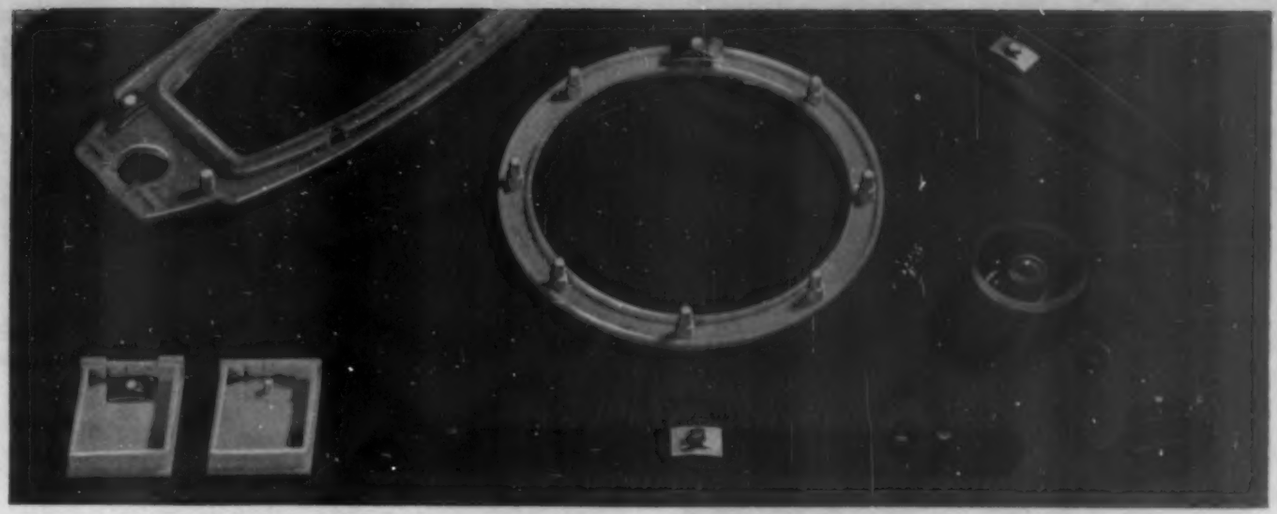
THOMAS S. GOSLIN, ASSISTANT SALES MANAGER, MAchinery Division, R. D. Wood Company, Philadelphia, Pa., died suddenly in Allentown, Pa., of heart ailment at the age of 56 years. Mr. Goslin was associated with the R. D. Wood Co. more than 33 years and was well known by the hydraulic machinery industry throughout the country.

TENNESSEE EASTMAN CORP. ANNOUNCES THAT THE NEW York World's Fair official colors have all been accurately matched in Tenite. This should be of particular interest to those who are planning novelties or other plastic products in conjunction with the World's Fair. The colors and their numerical equivalents in Tenite are as follows: World's Fair Blue—8568, World's Fair Orange—8567, Aqualon Pastels: Pink—8120, Blue—8814, Yellow—5229, Wine—8966. Sets of these color samples have been prepared for distribution to those interested in using Tenite in World's Fair colors next year.

DONALD DESKEY, INDUSTRIAL DESIGNER, HAS BEEN APpointed head of a department of industrial design at the New York University School of Architecture and Allied Arts.

A COMPLETE MINIATURE RAILROAD SYSTEM WITH AUTOmatically controlled freight and passenger trains racing through what is believed to be the largest diorama ever built, will be constructed for the combined exhibit of twenty-seven eastern Railroads for exhibition at the New York World's Fair.

The huge diorama will occupy 6400 square feet of area and will furnish about 100,000 man-hours of work for artists, sculptors, electricians and a half-dozen other skilled crafts. Work on the scenic effects will begin at once at the studios of Ivel Corporation, of New York.



CUT COSTS . . . IMPROVE ASSEMBLY OF PLASTIC PRODUCTS . . . WITH THE *SPEED NUT System*

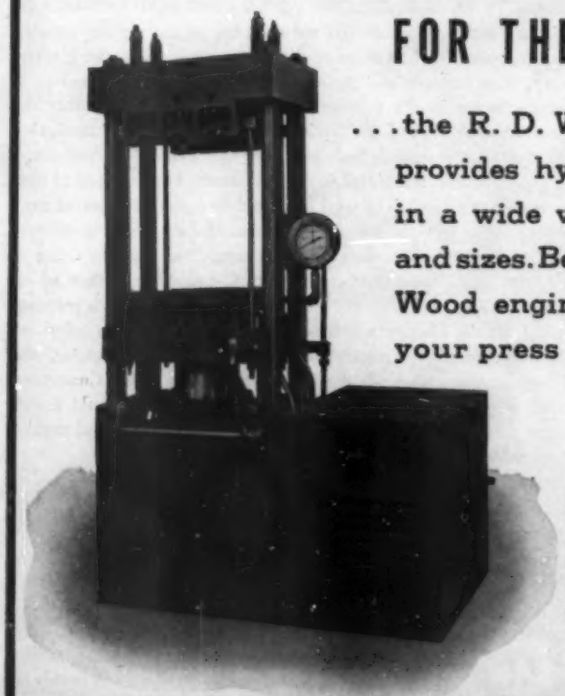
Most any product or part manufactured from thermoplastics may be assembled quicker, easier and better with the SPEED NUT System.

SPEED NUTS hold with a firm spring tension grip. They eliminate threaded inserts by means of integrally molded studs. They prevent vibration. They occupy less space. They are lighter in weight. They cut number of parts in half. Even die cast inserts for knob to shaft assembly are eliminated with the new SPEED CLIP. In most assemblies, SPEED NUTS are "zipped" on in clock-like fashion with a speed and ease that will amaze you. Write today for samples and prices, stating sizes and uses you contemplate.

SPEED NUT DIVISION

TINNERMAN STOVE & RANGE CO.
Manufacturers of Patented SPEED NUTS
2048 Fulton Road, Cleveland, Ohio

FOR THE PLASTICS INDUSTRY



. . . the R. D. Wood Company provides hydraulic presses in a wide variety of types and sizes. Be sure to consult Wood engineers regarding your press requirements.

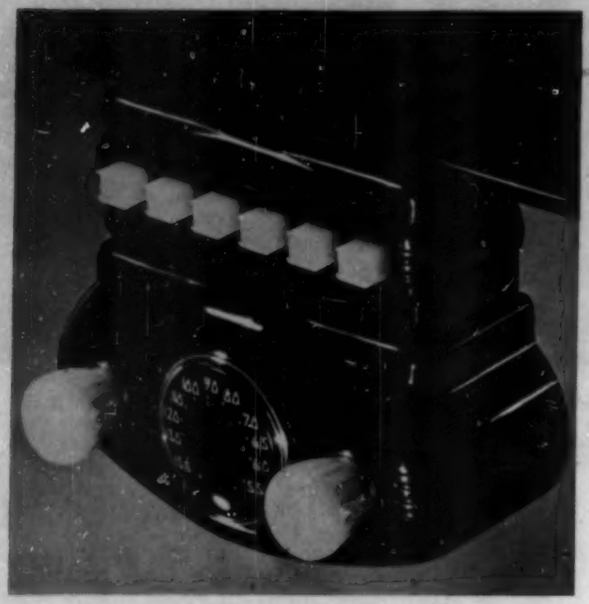
(Left) This 50 ton HydroLectric precision type molding press is operated by a two-pressure rotary pump at 200 pounds low pressure and 1000 pounds high pressure.

A 30 ton HydroLectric laboratory press with variable pressure pump and loading elevator. Pressure range—2 to 30 tons.

ESTABLISHED 1803 **R. D. WOOD CO.** PHILADELPHIA, PA.

HYDRAULIC PRESSES and VALVES for EVERY PURPOSE

NEWS



DIALING STATIONS ON THE AUTO RADIO IS NO PROBLEM with this automatic control. Simply push a button on the upper half of the control and one of six stations is dialed automatically. Knobs for the conventional method of tuning are provided on either side.

The housing, knobs and push-buttons of this unusual control are molded of Tenite. The housing is injection molded in two parts from single cavity molds. They are particularly thin-walled, depending upon well placed ribs and the high impact strength of the material to protect it against possible breakage. The reenforcing ribs are molded as an integral part of the housing.

In choosing Tenite in preference to die cast metal, the F. W. Stewart Mfg. Company effected a saving on the production of these control units. Elimination of metal finishing operations is given as the main reason for this economy. Another influencing factor in their choice of plastic is its exceptionally lustrous beauty. At the present time, the controls are being produced in black and brown with push-buttons and knobs of contrasting color. The housings and push-buttons are injection molded by the Elmer E. Mills Corporation.

GLYCO PRODUCTS CO., INC., NEW YORK CITY, ANNOUNCE that flexible shellac and casein are now available commercially. The former is called Flexilac. It is an orange colored non-inflammable, viscous resin which dries quickly to give a flexible glossy adhesive film which is water soluble but not affected by hydrocarbons. Because of this it may be used in cements for gaskets exposed to gasoline, naphtha, etc.

The flexible casein, called Protoflex is a straw colored transparent jelly which dissolves readily in water (without heat). Such a solution dries rapidly to give a flexible almost colorless transparent film.

J. A. EADES, MANAGER OF THE CHEMICAL DIVISION, Read Machinery Co., Inc., announces advancement of A. K. Brennan to the factory Engineering Division. Mr. Brennan was formerly located in the metropolitan New York area where he contacted, as sales engineer, many of the industrial and chemical organizations in New York and Northern New Jersey.

THE POWER PIPING DIVISION OF BLAW-KNOX COMPANY, Pittsburgh, Pa., manufacturers and erectors of prefabricated piping for power plants, oil refineries, and other industrial usages, has opened a southern sales office in the Candler Building, Atlanta, Georgia. O'Earl Kearney, who has had extensive experience in the power plant and industrial piping fields during the past twenty years, will be in charge.

WESLEY VAN NORMAN, 39 YEARS OLD, PROPRIETOR OF THE Van Norman Molding Company, 6437 South State Street, Chicago, was beaten to death early in the morning of August 12 by three Negro robbers who attacked him a short distance from his plant as he started to walk home.

After crushing his head with an iron pipe, according to Chicago newspapers, the robbers calmly rifled his pockets but fled when a witness who had heard his cries for help, started to drive to the scene.

The witness was John McCarthy who picks up and delivers cars for a garage located near the scene of the murder. McCarthy was driving a car to the garage when he heard the victim's cries. He says he saw Van Norman struggling with the three Negroes and saw one of them strike Van Norman with the pipe. The killers ran before McCarthy could reach them. Van Norman leaves a wife and a 9-year-old son.

INGERSOLL-RAND ANNOUNCES A UNIQUE NEW TURBINE-driven pump featuring a compact construction that combines both turbine and pump as one unit on a common shaft.

THE BUFFALO SCALE COMPANY ANNOUNCES THE DEVELOPment of a new line of automatic Batching Scales providing precision control of quality and cost where exact proportioning of materials is a critical operation in processing. The line offers a wide range of flexibility and adaptability for varying production requirements. A new Bulletin illustrating and describing the wide range of flexibility and adaptability provided by the various types is available.

A NEW WAX HAS JUST BEEN INTRODUCED BY GLYCO PRODucts Co., Inc., which, unlike most waxes, has the property of being sticky or adhesive. Waxes, in general, are characterized by their "slip" and poor adhesion to smooth surfaces. This new wax exhibits high adhesive properties even on glass and metals.

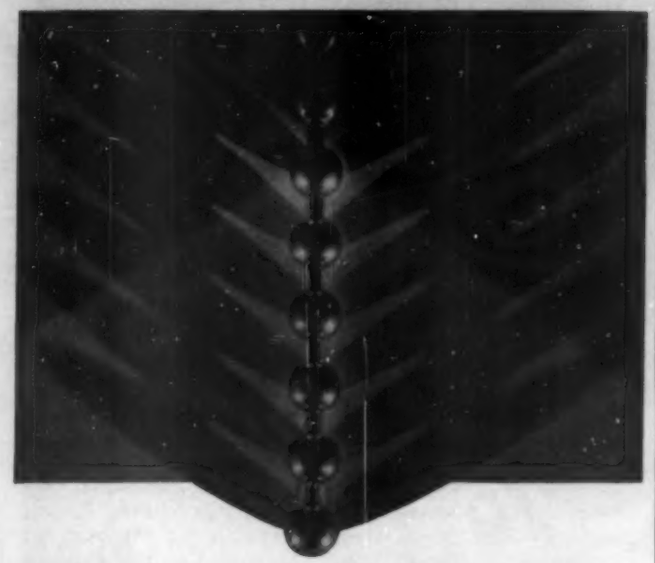
UNIFORMITY IN THE COLORS TO BE USED FOR BATHROOM and kitchen accessories has the endorsement of houseware experts. This was revealed in the results of a survey conducted by the Plaskon Company, manufacturers of "molded color," among 157 of the largest department stores in the country to determine just what effect the standardized color plan of the National Retail Dry Goods Association and the Bureau of Standards had upon their merchandising programs.

The questionnaire, submitted to the houseware buyers, showed that 85 percent of the executives who answered thought the idea of merchandising housewares in a series of consistent hues was a good one. Only 57 percent, however, the survey indicated, had done anything to promote the idea among their customers. The favorite method of acquainting the consumer with the uniform color scheme, which proposes six shades for the kitchen and seven for the bathroom, the colors selected being those which research showed to be the most popular, was by personal contact through the houseware salespeople. Customers' attention would be called to the ease with which they could match their new accessories with the old and have a harmonious and regular color ensemble practically always.

Although only 23 percent of the houseware buyers declared that there had been a noticeable demand for the recommended colors, 51 percent had found it feasible to modify houseware inventories to conform with the standards promulgated. Sixty-three percent of the executives stated that sales should increase once the idea became better and more widely known to the public.

Supplementary remarks in the survey were mostly concerned with emphasizing the further need of educating the public on the project and of concerted action on the part of everybody interested and involved. Forty-six percent of the buyers thought that there would be an economical decrease in their inventories. Thirty-seven percent said there would be no material change, and 17 percent declared that there would be an actual increase. Regarding buying costs, 69 percent stated that there would be little or no difference, 23 percent that they would be reduced and 8 percent that they would be increased.

INGENUITY



Practical and effective merchandising effects for a product can often be obtained by the introduction of BEAD CHAIN* in brilliant metal finishes, as for example, to hold a detachable cap.

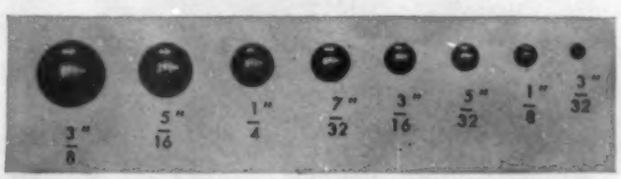
BEAD CHAIN*

is a series of perfect swivels, strong and non-kinkable. We have many attachments and couplings that give it unusual value in product construction and design.

BEAD CHAIN

Trade Mark Reg. U. S. Pat. Off.

BEAD CHAIN* is made in the sizes shown below, of various metals and in many finishes.



Our engineering department is prepared to cooperate fully with designers and manufacturers in developing economical and effective uses, assemblies and units of BEAD CHAIN* for their products.

THE BEAD CHAIN MANUFACTURING CO.
60 Mt. Grove St. Bridgeport, Conn.
*Reg. U. S. Pat. Off.

Would You Like
JAN STRENG
To Design Your Product?

The services of JAN STRENG, noted industrial designer, are now available to all clients of ASSOCIATED ATTLEBORO MFRS., INC.

Mr. Streng is the designer of outstanding plastic products in the lines of Westinghouse, Emerson, Colonial, Pilot, American Bosch, Philco, and numerous other firms. Mr. Streng's experience is wide and noteworthy. He ranks among America's greatest designers.

Thus to the numerous advantages which Associated Attleboro already offers in engineering and production . . . is added that of the finest design service available.

We invite inquiries on how Jan Streng and Associated Attleboro may aid you.

ASSOCIATED ATTLEBORO MANUFACTURERS, INC.

ATTLEBORO, MASS.

PUBLICATIONS

Booklets reviewed in these columns will be sent without charge to executives who write for them on their company letterheads. Other books will be sent postpaid at the publishers' advertised prices

Industrial Cold Adhesives

By Roger Dulac, translated by J. L. Rosenbaum
Published by J. B. Lippincott Co., Philadelphia, 1937
Price $3.50 **192 pages**

The adhesives shelf in the library has been one which bore a close resemblance to Old Mother Hubbard's cupboard. A volume on this subject is therefore certain to be a welcome addition to your bookworm's menu. The author has produced a very practical and helpful guide to those interested in selecting and formulating adhesives for various applications. The types of cold adhesives which receive attention include starch, dextrin, casein, glue, rosin, sodium silicate (special chapter by W. S. MacFarlane), cellulose, synthetic resin, and rubber. Other chapters cover items of interest to prospective manufacturers. The theoretical aspects of the mechanism of adhesion receive scant treatment, excusable perhaps because fundamental studies in this field have been relatively scarce.

The translator is to be congratulated on producing a smooth-reading English version of the French text. He notes in his preface one of the distinct limitations of the book, namely, the lack of completeness in dealing with synthetic resin adhesives, which are rapidly becoming of increasing importance in solving special problems of industrial adhesion.

Laboratoriumsbuch für die Organischen Plastischen Kunstmassen

by Emil J. Fischer
Published by Verlag Wilhelm Knapp, Halle (Saale), 1938
Price (foreign) RM 5.55 **96 pages**

There are quite a number of books available which treat of the chemistry of plastics and of the methods used in fabricating them, but this is believed to be the first one devoted almost exclusively to the determination of the chemical properties and chemical composition of these materials. It is admirably complete in the range of products covered, even including some of the borderline materials such as vulcanized fiber and cellophane.

The first of the four sections of the book describes test methods for determining specific gravity, softening point, water absorption, water solubles, resistance to chemicals, ash content, and plasticizing properties, and various special reactions for identifying chemical groups frequently present in plastics. The second section takes up each type of plastic separately, describing briefly its chemical background and in more detail identification and testing procedures. The third section deals with the raw materials, plasticizers, fillers, and coloring agents used in plastics, and the last presents in tabular form information pertaining to physical properties and in particular a schematic outline for the qualitative identification of the common plastics.

The book is the 34th volume of a series of laboratory manuals issued by the publisher concerning the chemical and related industries, and the editorial experience obtained in the preparation of these many texts is reflected in the skillful combination of thoroughness and compactness in this treatment of plastics. The plastics chemist is fortunate to have at his command this valuable guide to chemical testing in his field.

AMERICAN CONCRETE AND STEEL PIPE COMPANY, LOS Angeles, California, has available a 16-page booklet on Amercoat cold-applied coatings. These coatings are basically synthetic organic plastic in nature. They contain no paint oils whatsoever and incorporate a series of coatings for resistance to acid and alkali corrosion of the severest sort; coatings for ship bottoms and harbor structures as well as ships superstructures; coatings for lining steel containers of concentrated acids and alkalies; and metallic and non-metallic coatings for the exterior protection of concrete, metal and wood, machinery, etc.

THE GROTELITE COMPANY, BELLEVUE, KENTUCKY, HAS A new broadside describing the Grotelite injection press. It also shows the development of this type of molding press from its beginning in 1923.

CHICAGO MOLDED PRODUCTS CORPORATION HAS PUBLISHED a booklet showing many stock parts available from stock molds owned by the company. Gear shift balls, knobs of many sizes, shapes and purposes, handles, stop buttons, tube base sockets, horn buttons, switches, bushings and bobbins are included together with the dimensions and illustrations of each. The booklet also includes a chapter on Design; one on Building Molds; and another titled, "What Price Molded Parts."

RECOMMENDATIONS FOR OFFICE LIGHTING, A 16-PAGE booklet published by F. W. Wakefield Brass Co., Vermilion, Ohio, outlines the advantages of good office lighting, tells how to determine whether or not present facilities are adequate, and suggests various types of fixtures with plastic reflectors wherever improvement is needed.

"PLASTICIZING OILS" A NEW SIX-PAGE BOOKLET, HAS BEEN issued by The Neville Company. It includes information on Nevinol, No. 2 Refined Heavy Oil, No. 1-D Heavy Oil, and PHO, together with their specifications and properties.

GLYCO PRODUCTS CO. ANNOUNCES A NEW FLAME-PROOFING agent called Abopon Special, which it is claimed can be handled more easily and which practically eliminates "after-glow" on such hazardous materials as kapok, plush, velvet, cotton-batting, etc. Although this material is not waterproof it dissolves but slowly when exposed to rain and is claimed to meet the stringent requirements set up by users in the airplane, steamship and railway fields. Where permanent waterproofness is necessary, users first apply it to the material to be flame-proofed and allow it to dry (it dries quickly). Then they coat with a waterproofing such as lacquer or varnish which adheres firmly to the flame-proof coating. Descriptive booklet available.

BAKELITE CORP. IS DISTRIBUTING A COLORFUL FOUR-PAGE folder describing their rainbow-hued cellulose-acetate material for injection and compression molding. Toughness, resiliency, high tensile and impact strengths are but a few of the desirable characteristics of this material which is available in opaque, translucent and crystal-clear transparent effects, as well as mottled or variegated colors.

EQUIPMENT

THE RAYMOND PULVERIZER DIVISION OF COMBUSTION Engineering Company, Inc., announces the development of a small hammer-type pulverizer for test-grinding operations in the production of powdered materials. It is a motor-driven unit, equipped with a hand-operated screw feeder and five different size perforated screens to give a wide range of classification of the product. Bulletin available.

Night Life with Stokes Molded Plastics

Many a production man and sales manager who have turned the job over to Stokes are resting more comfortably at night. They may be sitting up but they're not worrying.

In this Bed Lamp Shade, molded for EAGLE ELECTRIC CO., Brooklyn, N. Y., you see the result of long experience in plastic engineering and molding—a quality piece molded at a cost low enough to attract a volume market. The shade, done in a range of delicate pastels, with a high finish, sheds a soft glow of light that is easy on the eyes.

Possibly this molding suggests the means to an end of your production worries and a lowering sales curve. Stokes stands ready to work with you on anything from a rough sketch to complete blueprints.

JOSEPH STOKES RUBBER CO.

322 Webster St.
TRENTON, N. J.

Canadian Plant
WELLAND, ONT.

MOLDERS OF ALL PLASTICS—*including*
HARD RUBBER—SINCE 1897

A Choice Lake Resort for Discriminating People

SWIMMING • YACHTS • POWER BOATS • FISHING

GOLF • TENNIS • BADMINTON • HORSES • DANCING

On Beautiful Lake Wawasee—largest lake in Indiana—116 miles from Chicago
Easy accessibility—2 Main Railroads—Good Highways—Airport.
Convention Hall adjoins Hotel—Seats 400

Season May to October

Enquiries invited

SPINK-WAWASEE HOTEL, WAWASEE, IND.

EQUIPMENT

AN ENTIRELY NEW GLASS-INSPECTION POLARISCOPE, THE most sensitive machine of its kind ever developed, has been announced by The Polaroid Corporation, 120 Columbus Avenue, Boston. Designed to specifications set by the Testing Committee of the Glass Container Association, it offers the glass industry a simple, precise, convenient means of detecting strains in glass containers and glass products of all kinds. It has high precision for practically all laboratory requirements, and is sturdily built for use in the plant for routine inspection of items in quantity production.

The operator views the test objects through a binocular eye piece against a powerful light source. The field is 10 in. in diameter, accommodating containers up to one-gallon size. Smaller sizes can be viewed simultaneously for comparison, and larger pieces can be inspected one part at a time.

Strains appear in brilliant color, enabling the operator to pass or reject pieces rapidly with minimum eye fatigue. With the use of Polaroid Strain Inspection Spectacles, several observers can view an object at the same time, permitting quick accurate observation and discussion on questionable specimens. This feature is also of value in training new operators. Built throughout for strength and freedom from operating and maintenance trouble, the machine is easily kept in proper operating condition at all times. The entire polarizing assembly is protected from breakage by a thick sheet of unbreakable transparent plastic, and mounted in shock absorbing gaskets.

THE GEORGE SCHERR COMPANY IS NOW HANDLING A UNIversal Mauser Precision tool, which is being widely used in plastics work. The instrument is a Vernier Caliper measuring in 1/1000 in. and in 1/128 in. up to $5^{3}/_{16}$ in. It may be used for inside, outside, root and depth measurements. It has a cam lock for quick setting and glass-hard measuring surfaces. This tool, Mauser No. 64, comes in both chrome and stainless steel models. Molders find them particularly helpful in transferring inside to outside dimensions, which is a common practice in molding construction. Many toolmakers use the Mauser No. 64 for precision work in 1/1000 in. The Depth Gage attachment is used to measure quickly the depths of molds as they are made by the diemaker. In many instances, production has been doubled with this quick-measuring universal tool.

SPEEDWAY MANUFACTURING CO., CICERO, ILL., ANNOUNCE a new model of miniature home workshop grinders and drills at a popular price. Industry, the company reports, seems to find many trick uses for this miniature equipment where light duty and intermittent work do not overtax its capacity. The drill is about the size and weight of a pocket pistol; the grinder is about the proportion of a small apple which fits comfortably into the hand.

IN THE MOLDING OF PLASTICS AND MECHANICAL RUBBER goods, one of the sources of flaws is the trapping of air or gas bubbles which form pits or pock marks on the product surface. These flaws are preventable by slightly and momentarily opening the platen press (an operation known as "bumping" or "cracking") several times at the beginning or near the end of the curing cycle, depending on the product being processed. The press actually should not open during the cure; the pressure on the product should be merely released sufficiently to permit the escape of the entrapped air or gas.

The Taylor Instrument Companies, Rochester, New York, have perfected a method of automatic "bumping" which is an auxiliary function of their standard adjustable and fixed-cam types of pneumatic time-cycle controllers used for automatically regulating the curing period. With this new feature, either type of timer will "bump" the press at the start of the curing period or at some later interval, as required. The duration of the bumping period is readily adapted to the ram speed of the press by an adjustable sector on the cam.

A NEW AND RADICALLY IMPROVED SWEAT PAD USING SANItary, easily sterilized du Pont cellulose sponge pad with one-piece Latex headband for use by industrial workers is announced by the American Allsafe Company, Inc., Buffalo, N. Y.

The high potential sweat absorption properties of Drybrow absorb 20 times its weight in moisture. It speeds up production by eliminating interruptions for wiping eyes and goggles. It contributes to safety by eliminating steamed-up, foggy goggles and reducing the temptation to omit wearing goggles on hazardous operations.

Applied moist, it stimulates evaporation with consequent head coolness and comfort, thus relieving heat fatigue and reducing the possibility of heat prostration.

Du Pont cellulose pad is easily washed and can be quickly sterilized in boiling water or steam. It resists chemical action of sweat and grease, thus adding the economies of long life to low first cost.

BARKON-FRINK TUBE LIGHTING CORP., LONG ISLAND CITY, N. Y., make this fluorescent tube fixture for color examination and general inspection work. These fixtures use the new mercury discharge tubes with an inside fluorescent coating which under the action of the ultra violet radiation of the mercury arc becomes an efficient source of high quality illumination. The light closely approaches average daylight in quality and is an excellent source of light for color grading. The fixture can also be supplied with white fluorescent tubes which provide a light approaching that of regular incandescent lamps.

DU PONT

P.A.C. FORMALDEHYDE
REG. U.S. PAT. OFF.
U. S. P. Solution; Water White; Low in Acid; Low Metal Content

PARAFORMALDEHYDE
95% Minimum Strength

HEXAMETHYLENETETRAMINE
Products of Dependable Uniformity
. . . Prompt Shipments in Modern Containers

DU PONT
REG. U.S. PAT. OFF.

The R. & H. Chemicals Department
E. I. DU PONT DE NEMOURS & COMPANY, INC.
Wilmington, Delaware

District Sales Offices: Baltimore, Boston, Charlotte, Chicago, Cleveland, Kansas City, Newark, New York, Philadelphia, Pittsburgh, San Francisco

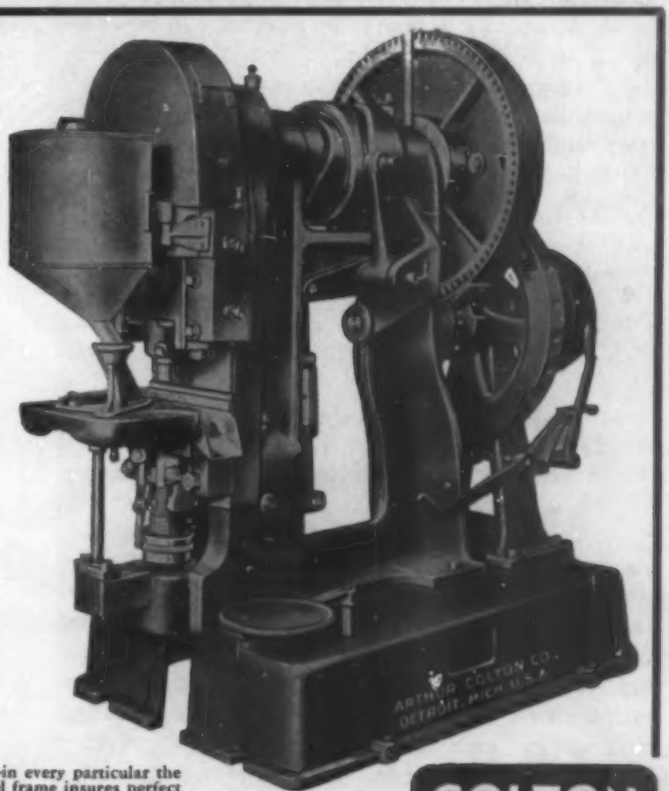
The most modern molding press will be inefficient

UNLESS . . .

A COLTON PREFORMING machine backs it up!

Colton Preforming Machines are the accepted standard in the plastics industry not only because they speed up the molding cycle but because their unvarying accuracy of performance is a guarantee of better molding at the press. When Colton preform-pellets are used material waste is eliminated, flash is held to the ideal minimum, material handling problems are simplified and costs d
r
o
p

Write us for full details about our complete line of single punch, multiple and rotary preforming machines.



ARTHUR COLTON CO.
2604 E. JEFFERSON AVENUE
DETROIT, MICHIGAN

The new improved 5½ tablet machine—in every particular the finest the market has to offer. Solid steel frame insures perfect operation; improved die fasteners, improved cam construction, heavier ejecting mechanism, vanadium steel plungers—make high speeds possible without fear of breakdown or lowered quality. Makes tablets up to 3" in dia. having a fill depth up to 2⅛".

COLTON DETROIT

MATERIALS FOR AIRCRAFT

Research problems (*Continued from page 46*)

The exploration of the potential applications of reinforced plastics to aircraft construction is in its infancy, and is still uncharted. Research in this field must include problems relating to: the choice of resin and reinforcing material; the method of combining and forming them into a suitable product; the testing of such products to determine whether they possess the requisite physical characteristics; the design of structural members to take full advantage of the properties and fabrication possibilities of plastics; and the equipment for forming the separate sections and the technique of joining these sections to produce the finished aircraft. In the determination of the physical properties, it will be necessary to consider the anisotropic nature of the reinforced materials and to make the measurements along the various axes accordingly.

The stress-strain curve for reinforced resins is dependent on the rate at which the load is applied. When a stress is applied, the strain does not instantaneously reach its maximum value. The magnitude of this "elastic after-effect" increases with the stress. De Bruyne[3] notes that this "after-effect" is largely reversible and becomes very nearly so after the load has been applied and removed four or five times. The irreversible component of the creep becomes more noticeable at high stresses. This property is of prime importance with reference to the use of reinforced phenolics for structural members of aircraft and should be investigated in detail for any materials which may appear to be promising in other respects. It is also to be expected that creep, endurance limit, damping, impact strength, and other properties of phenolic reinforced plastics will vary somewhat with temperature. The behavior of these materials should be studied at various temperatures within the range which might be expected to be encountered in service.

Present outlook for commercial applications

In the fabrication of aircraft today the labor costs are high relative to the costs of tools. If large sections could be molded in one piece, the labor costs would be reduced but the costs of the molds and presses would be very high. Such a change in type of construction would not be economically practicable except in the mass production of aircraft of a standard design. Langley[16] suggests, therefore, that progress in the utilization of plastics in aircraft construction will be made by the gradual introduction of these materials into an otherwise orthodox structure, and that the early stages of this development will involve the molding of such small units as fins and rudders and the fabrication of the larger units from reinforced sheets and molded sections by conventional methods of jointing. Controllable pitch propeller blades have been made from reinforced plastics in this country[17] and are currently being manufactured in Germany and England. An airplane in which the wings and fuselage were each molded in one piece of extremely thin laminated films of wood and cellulose acetate was designed and built by Atwood[18] and successfully flown. But this type of material is not believed to be suitable for general use in aircraft construction because plastics made with cellulose acetate are subject to cold flow under low loads and to considerable variation in moisture content at different humidities, resulting in excessive dimensional changes and warping. De Bruyne[3] has presented in some detail theoretical considerations pertaining to the application of reinforced phenolic plastics for various structural parts of aircraft, such as spars, cowlings, struts, and covering. However, until more information is available on the problem of combining resin and reinforcing agent in such manner as to obtain requisite strength and stiffness and until such products have been thoroughly tested to determine their behavior under repeated stresses, it is too early to make any considerable progress on the design and fabricating problems.

2. O. Kraemer, Synthetic Resins and Their Development for Airplane Structural Materials, Jahrbuch 1933 der Deutschen Versuchsanstalt fur Luftfahrt, Part VI, pp. 69–81.
3. N. A. de Bruyne, Plastic Materials for Aircraft Construction, Journal of the Royal Aeronautical Society, Vol. 41, pp. 523–590, July 1937.
4. G. de Havilland, Filled Resins and Aircraft Construction, Journal of the Aeronautical Sciences, Vol. 3, pp. 356–357, August 1936.
5. For a complete bibliography see G. M. Kline, Plastics as Structural Materials for Aircraft, N.A.C.A. Technical Note No. 628, December 1937.
6. K. Riechers, Plastics in Aircraft Construction, Luftwissen, Vol. 4, pp. 235–242, August 1937. Cf. N.A.C.A. Technical Memorandum No. 841, November 1937.
7. The values listed in Table 2 have been compiled from the following sources: for stainless steel, chrome-molybdenum steel, aluminum alloy and aircraft spruce, from A. Klemin, Metal Airplane Construction, Aero Digest, Vol. 27, pp. 43–45 and 112–113, July 1935; for magnesium alloy, from Z. Jeffries, Light-Weight Metals in the Transportation Industry, Metals Technology, Vol. 3, Symposium on Role of Metals in New Transportation, pp. 21–39, October 1936, and a bulletin on "Dow metal" published by the Dow Chemical Company; for birch plywood and birch-reinforced resin, from Kraemer (see footnote 2); and for resins reinforced with paper, fabric, and cord from de Bruyne (see footnote 3), M. Langley, Plastics in Aircraft Construction, British Plastics, Vol. 9, pp. 5–8, June; pp. 55–58, July; and pp. 185–190, September, 1937, and R. Hamard, Synthetic Resins in Aircraft Construction, L'Aéronautique, Vol. 19, pp. 231–235, October 1937.
8. F. R. Shanley, Pounds or Pounds per Square Inch, Aviation, Vol. 35, pp. 27–29, November, 1936.
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PLASTICS PAY THEIR DEBT TO PURE SCIENCE

(*Continued from page 23*)

By following this method, it is possible to obtain an excellent adherence of the specimen to the plastic mounting. The features are: freedom from relief polish, margins or crevices; uniform shape of mounting and convenience in handling; plus resistance to the various reagents used in examining metallurgical and geological specimens. Another most important factor is that the variety of colors and transparencies in which these plastics are available makes possible the maximum contrast between specimen and mounting, thus making possible a clearer observation by the scientist.

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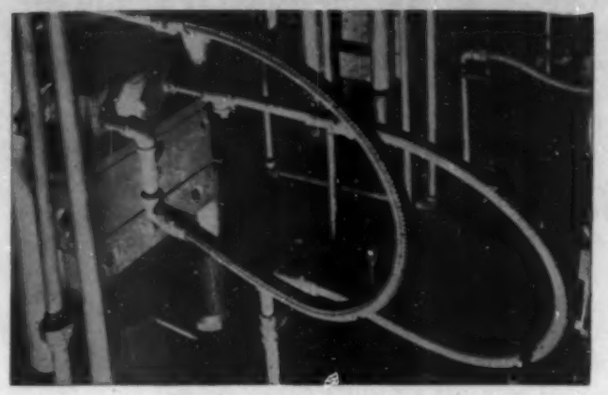

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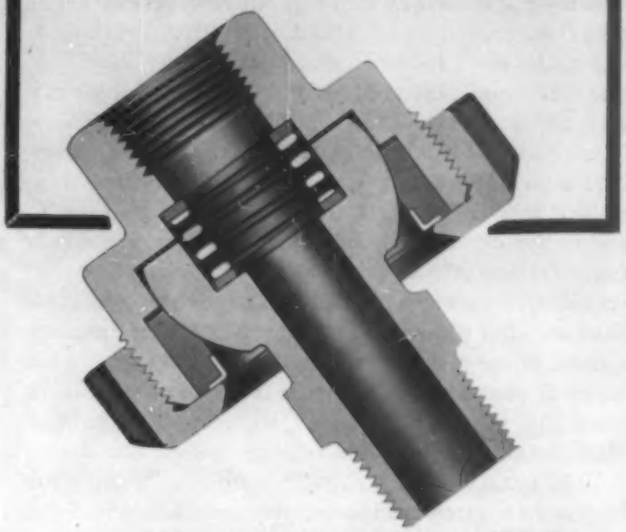

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NEW FREEDOM, PENN.

In fact, the largest microscope in the world—developed by Professor L. C. Graton, with the assistance of Dr. E. B. Dane, Jr., in Harvard University's laboratory of mining geology—utilizes plastics as a material for mounting specimens. The new microscope has a potential magnification of 50,000 diameters. As Herbert L. Nichols of "The Christian Science Monitor" said, "A size that would make the period at the end of this sentence appear 45 feet in diameter." And that is pretty big. However, the law of diminishing returns applies here as well as in economics; such a tremendous enlargement is like a "blow-up" from a miniature camera. It makes the detail easier to see but, according to Professor Graton, actually discloses no more detail than it would within a range of 4,000 to 6,000 diameters magnification. But the important factor here is that Professor Graton before going ahead with the development of his super-microscope, found that he must find an adequate mounting for his specimens. He selected a molded plastic to answer his riddle:

"The metal bearing components are opaque and must be given a mirror polish for microscopical study by light reflected from them. Polished sections of suitable high quality have been peculiarly difficult to produce, chiefly because the various components differed so greatly in hardness that the softer minerals wear down faster than the hard ones, thus producing an uneven surface ill-suited to high powered microscopy."

While it has only been possible in this short article to summarize very briefly a few of the most recent contributions of plastics to scientific research, there is no gainsaying the fact that literally every day plastics in their various forms are playing an increasing part in the advancement of science. Durability, resistance to stress and strain, resistance to reagents, precision in the creation of individual pieces, variety of colors available—these are the fundamental characteristics that stimulate the imagination of the searching scientist in his studies, and the industrialist in his search for the material that will create dividends.

METALIZING PLASTICS

(Continued from page 31)

That isn't all, by a long shot. One of the greatest economies promised by the discovery of this new plating process is in making false teeth. We all know that vulcanized plates or those made of numerous plastic materials are cheaper than those made of precious metals. This is chiefly because they are easier to form. The materials themselves are less costly. They can be cast from the original impression of the mouth with much less effort and expense than can metals. Yet certain metals are claimed to have an advantage over any other type of dental plate. They can be more thoroughly cleaned and bacteria is less likely to get a grip. Gold and other precious metal plates are recommended almost universally by dentists for these substantial reasons.

There is no reason now, why any one cannot afford a 14 k. gold dental plate because through this metalizing process, any of the popular dental plate materials may be gold plated to seal the pores and give every advantage of the all-gold plate with less weight and considerably less cost. Besides, plastic plates have the advantage of heat insulation for the protection of the delicate tissues of the mouth which this plating does not destroy.

It is easy to electroplate plastics when you know how. Trouble is to make the metal stick to the glossy surface of the plastic materials. The whole secret lies in a bond coat which is put on the plastic first, a chemical substance—in fact, two chemical substances—applied separately by tumbling or agitation. This gives the plastic piece a smoky gray surface which when immersed in the plating bath has a natural affinity for the metal plate. A plating of any thickness up to $^1/_{100}$ of an inch can be applied but usually $^1/_{1000}$ in. is sufficient for commercial wear. The plate, of course, can be scraped off with a sharp instrument, but it is claimed that it doesn't peel.

The bond coat was worked out by a young chap, Bernard F. Walker, who attended Far Rockaway High School seven years ago. He did most of his experimental work, however, in France where he lived for four years and a half with his parents. His father, Irving Walker, has been connected with European business representing American firms for twenty years. Bernard went to France where he studied at The Richelieu and Sorbonne. He was intrigued with chemistry and its possibilities and set up a small laboratory at his home. He was experimenting with plating on glass when his father ran across a French manufacturer who was trying to do some plating on plastics, but without success. Bernard became interested and in less than two years worked out a process by which it could be done.

It was then decided to bring the idea to America. Patents were applied for and for the past year Bernard has been quietly studying American materials and their peculiarities, experimenting with them in a small lab which he set up in Brooklyn. When this news got around in the trade it developed that there is quite a demand for plating on plastics so a laboratory has been established in New York City under the name, Metaplast Corporation, of which Bernard is vice-president.

"We do not plan to go into the plating business," says Bernard, "but we want to make the process available to the trade through license. We shall also supply the necessary chemicals for the bond coat and work with our licensees to further perfect the process and develop new possibilities for its use. We shall maintain a pilot plant where this experimenting will be carried on and where we are in a position to demonstrate the value of the process to anyone interested.

"If a manufacturer already has plating equipment, little additional expense is involved. But if he wishes to set up a plant, we shall be in a position to advise him. Molders who have long production runs will find it more economical to maintain a small plating plant than to have the work done outside with incidental shipping expense and loss of time."

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➡ ENGLISHMAN—Late actively associated with plastic production and selling in England is desirous of handling American completely moulded articles and would be interested also in accessory moulding equipment. Reply Box 241, Modern Plastics.

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➡ MECHANICAL ENGINEER, 36, wide experience in plastic molding, mechanical and electrical fields. Creative and organizing ability. Now in responsible position with plastic molding firm. Desires change and real opportunity. Reply Box 242, Modern Plastics.

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➡ A FACTORY REPRESENTATIVE calling on Plastics Industry desires to take on one or two additional lines of machinery, material or supplies for this industry. Reply Box 243, Modern Plastics.

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➡ "Wanted for immediate and future deliveries Plastics raw-materials surplus, nitrate and acetate waste, casein scrap, fillers, chemicals, colors. Send details concerning price and quantity. Reply Box 245, Modern Plastics.

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➡ Plastic sales or service engineer seeks connection with raw material or machinery supplier to the molding industry. Well known in molding field. Considerable previous experience in sales and service on molding compounds and resins. Reply Box 246, Modern Plastics.

PLASTICS FOR COMPACTNESS

The old saying, "Good things come in small packages," was never more aptly applied than to the new Detrola Pee-Wee and Super Pee-Wee radios. Brilliant in tone and performance, their amazingly compact chassis are mounted in rich settings of molded plastic materials.... The cabinets, available in a wide variety of color combinations, were designed by George Walker and produced by Chicago Molded Products Corporation for Detrola Corporation of Detroit.... Whether your plastic molding problem is one of appearance, of mechanical accuracy, or of quantity production, you will find the best and most economical solution in the facilities of Chicago Molded. Write for your copy of "The Story of Plastic Molding."

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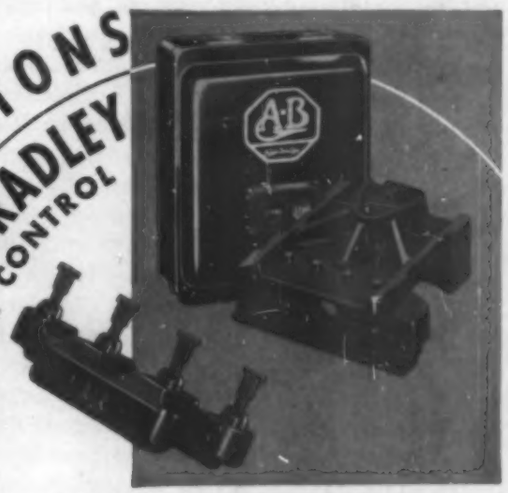

While achieving the utmost simplicity in their powerful Bulletin 709 Starter, Allen-Bradley Co. also simplified their tool room work with Gorton Duplicators. The original molds for the 4-pole cross bars and thermal relay blocks above were cut to dimensions on the Duplicator with milling cutters. All duplicate and multiple cavity molds are produced with the duplicating attachment.

Mold costs have been so much reduced by Gortons that it pays now to have several identical molds on hand. This saves in molding operations and prevents any chance of holding up production of plastic parts for lack of molds to work with.

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SOYBEANS IN THE PRODUCTION OF PROTEIN PLASTICS

(*Continued from page 43*) increases the strength of the resulting plastic. As evidence of this, reference may be made to the numerous patents covering mixtures of protein materials with phenolic, urea-formaldehyde, and other resinous combinations as well as to the development of the soybean meal plastic already mentioned (5, 11). A preliminary investigation of this field has been made, and dtffers from all previous work along this line in the fact that the principal plastic in the composition in this case was the thermoplastic formaldehyde-hardened protein, properties of which were modified by the addition of a commercial molding compound. In this connection, phenolics, urea-formaldehyde, vinyl resin, methyl methacrylate resin, and cellulose acetate were studied. The first two were found to be compatible, the last three incompatible, as illustrated clearly in the photomicrographs of Figure 2. (On page 43.)

It was found that with either phenolic molding compounds or urea-formaldehyde, the thermoplastic formaldehyde-hardened protein material with water content reduced to 3–4 percent flowed freely enough in most cases to dispense with the ethylene glycol, and the water resistance was improved. Mixtures of thermoplastic formaldehyde-hardened soybean alpha protein and of the thermoplastic formaldehyde-hardened solvent-extracted soybean meal were mixed in a ball mill with 25, 50, and 75 percent clear resin phenolic molding material, regular opaque phenolic molding material, and urea-formaldehyde molding powder. In every case a clean-cut, homogeneous molded piece resulted, which could be removed from the die without chilling. The plastic resulting from a mixture of 75 percent thermoplastic formaldehyde-hardened soybean protein and 25 percent commercial phenolic molding compound was especially interesting in that it appeared more homogeneous, and more resin-like than the phenolic molding compound alone. The water absorption was about 10 percent in 24 hours, but further experimenting is expected to considerably decrease this amount. The water absorption on the similar material prepared with the thermoplastic formaldehyde-hardened fat-free soybean meal was rather high, but the test piece did not disintegrate in the water and the molded piece was light and quite strong. This may well serve as the basis for the development of a good cheap plastic molding material, as the solvent-extracted soybean flour can be bought for about $40 per ton and the process of hardening and mixing it with the phenolic would be simple and inexpensive.

This work, which has also been covered by a patent application, is being continued. Numerical data have been obtained upon which some definite conclusions may later be drawn. It is felt that this is but a small part of what may be possible from the development of practical applications of the thermoplastic-hardened soybean protein material. Further possible applications cannot be predicted at this time, but it is certain that this is a fertile field for investigation of new plastic materials.

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PRECISION SHAPES

(*Continued from page 38*) prevent warping under any atmospheric conditions. The fact that these shapes can be slotted in many different ways, widths and angles enable them to hold material such as glass or metal.

Probably the warmest welcome given the new products has been by industrial designers. One well known designer recently made inquiries and was furnished samples of a complex section, less than $^1/_{100}$ in. thick, $^1/_8$ in. in diameter, with 6 slots. Tremendous interest has been shown also by designers and manufacturers of furniture.

Although these shapes are practically unknown to industry and the public generally, makers of miniature models—architects, engineers and inventors—in many parts of the world have availed themselves of this material, and new thousands will undoubtedly do so as it is made more readily available to them. Some of the requests for samples and data come from manufacturers of dioramas and exhibits, jewelry display cases, showcases and clock makers. Schools, colleges and museums are also greatly interested from the stand-point of producing models and engineering exhibits at lower cost than by former methods, and with greater precision.

The use of these shapes is a challenge to the ingenuity of the industrial designer and engineer. For instance, they can be used in many points where actual strength must be contributed to the structure, as well as for decoration. As an example, with a material of 61 percent copper, $2^1/_2$ percent lead and the balance zinc, a tensile strength of 60,000 pounds minimum is developed with an elongation of 15 percent in a 2 in. specimen piece and a bend test of 120 degrees. Brass of various compositions can be used and the shapes can be threaded or otherwise treated at one end, while the other end retains its decorative form, making it possible to be used effectively with transparent plastics in many cases where the sight of the operating mechanism has been considered objectionable.

Other formulae can be employed where the use is solely of a decorative nature without stresses. The section forms can be such as to readily permit the flow of the plastic into the section slots to give a permanent juncture or bond which renders the shape an integral part of the finished piece. The combination of the metallic element with the various plastic colors gives a range of uses which will delight the imagination of the designer. Sample boards of the new material have been made available recently, and the manufacturer is now active in commercial production.

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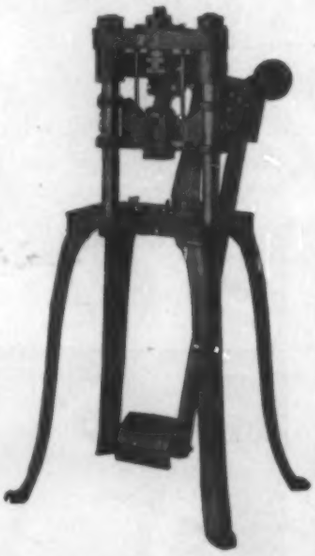

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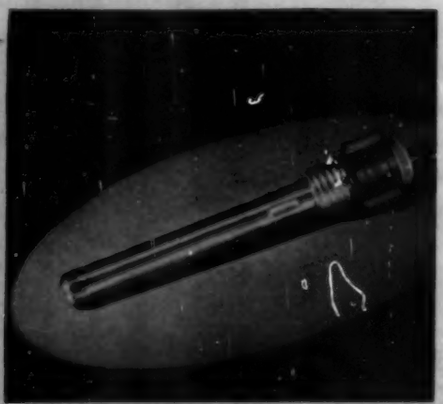

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1. A new thermos bottle produced by the Aladdin Co. has an ivory Plaskon cap which serves both as a cover and drinking cup. These caps, which will retain their clean, smooth finish are molded by Chicago Molded Products Corp.

2. Dressing rooms on the recently completed 75-passenger Boeing Stratoliner air transport are fitted with Lumarith tube lights of modern design. Because they are light weight, non-inflammable, non-shatterable, and have excellent light diffusion qualities, these fixtures are particularly adaptable for aircraft illumination and decoration

3. "Pepper & Salter" a moistureproof container with base and cap injection molded of Tenite by Detroit Molded Products Co. for Nelson Mfg. Co. Salt and pepper, separated by a partition in the base and indicated on the cap by black and white dots, sift through proper sized openings on each side when the cap is turned to the right position

4. A streamlined Bakelite housing provides efficient electrical and thermal insulation for the Sunbeam Shavemaster. Molded by Chicago Molded Products Corp. for Chicago Flexible Shaft Co.

5. Waterproof matchbox molded of Durez by Alco Mfg. Co. is unaffected by water, mild acids, alkalies, oils and greases. A rubber washer between the red cap and black vial helps the waterproofness and makes the box easy to open

6. Wasp Pen Co.'s new Rite-O-Way pen set has a two-piece shell molded of Durez which provides a lustrous wearproof surface that is resistant to ink chemicals. Two threads are molded into the bottom of the well by means of which an inverted bottle of ink may be screwed tightly in place, and this is covered by a slip-fit cap

7. Lamicoid (Bakelite laminated) coffee table that is not affected by hot coffee, tea or alcoholic beverages. Modern effects are achieved by veneering red, black and natural wood Lamicoid to a plywood frame. Fabricated by Dalmo Sales Corp.

8. Electric, thermostatically controlled hot water bottle heater with handle molded of red or black Textolite by General Electric Co. for Wilfred J. Turenne. Screwed snugly into the bottle in place of the usual stopper, the heater maintains the temperature of the water at a constant level

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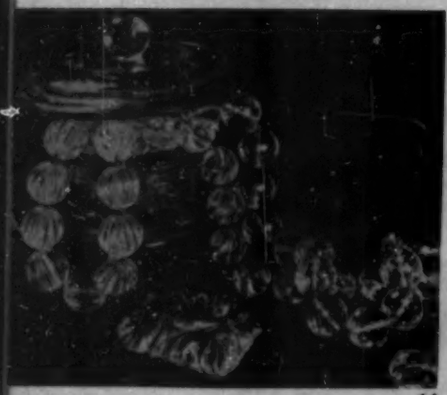

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9. Blinker type sun glasses, originally stamped from sheet stock, are now being injection molded in a little different shape to retail at a popular price. Distributed by Ben Hur

10. Number rings on F. B. Redington Co.'s counting machines are double injection molded of Tenite by Gitts Corp. Black rings with letter shaped holes are injection molded first; a second injection flows white behind the black and the white letters become an integral part of the ring and cannot wear through

11. Solid or flexible bracelets, brooches, necklaces and rings of clear transparent Plexiglas are being featured by German manufacturers. Intricately carved designs and skillfully cut stones have all the beauty and charm of rock crystal and are light weight and comfortable to wear

12. The Zephyr Autodex for telephone numbers and addresses has a black, brown, antique ivory or walnut Bakelite case with contrasting arrow and button colors. Molded by Accurate Molding Co. for Autopoint Co.

13. Three washing machine fittings injection molded of acetate by Erie Resistor Corp. for Lovell Mfg. Co. The center piece which controls the position of the wringer is molded around a large metal insert. By bracing the interior, the advantages of thin-wall construction are retained without sacrificing strength

14. Variegated Tenite, molded in two parts, makes the U. S. DeLuxe Auto Compass an attractive fitting for modern cars. Molded by American Insulator Corp. for U. S. Gauge Co.

15. Tom Thumb radios are housed in Catalin cabinets that may be had in nile green, azure blue, red, virgin gold, orchid or ivory. The radio, a five tube superheterodyne receiver with dynamic speaker, operates on either AC or DC current. Designed by J. Samson Spencer for Automatic Radio Mfg. Co., Inc.

16. The Polar Cub electric vibrator has a Durez housing held in position by a metal fastening band. A finger touch button at the rear controls speed and vibration strength. Designed by Robert Heller for A. C. Gilbert Co.

Manufacturers' addresses will be sent if you will write to the Editor, enclosing 3-cent stamp for reply